

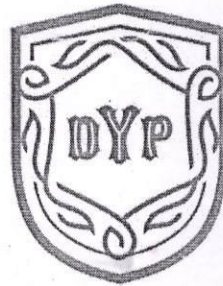
D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

NBA Accredited

Accredited by NAAC with 'A' Grade



D Y PATIL

COLLEGE *of*

ENGINEERING & TECHNOLOGY

(AN AUTONOMOUS INSTITUTE)

KASABA BAWADA, KOLHAPUR

Structure and Syllabus

(As per NEP 2020)

for

Second Year B. Tech in

**Computer Science and Engineering
(Artificial Intelligence and Machine
Learning)**

Department of CS-AIML

w. e. f. 2024-25

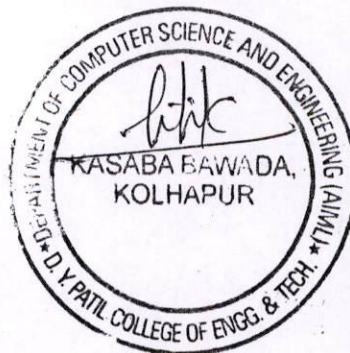
Teaching and Evaluation Scheme from Year 2024-25 (as per NEP 2020)

SEMESTER-III													
Sr. No	Course Code	Course Type	Course Name	Credits	Teaching Scheme			Theory			Practical		Total Marks
					Contact Hrs			ISE	MSE	ESE	INT	OE/POE	
					L	P	T						
1	231AIMLPCCL201	PCC	Data Structures using C	3	3	-	-	20	30	50	-	-	100
2	231AIMLPCCL202	PCC	Fundamentals of Artificial Intelligence	2	2	-	-	20	30	-	-	-	50
3	231AIMLPCCL203	PCC	Discrete Mathematics and Graph Theory	3	3	-	-	20	30	50	-	-	100
4	231AIMLPCCP201	PCC	Data Structures using C Laboratory	1	-	2	-	-	-	-	25	25	50
5	231AIMLPCCP202	PCC	Fundamentals of Artificial Intelligence Laboratory	1	-	2	-	-	-	-	25	25	50
6	231AIMLCEPP201	CEP/FP	Introduction to OOPS & Java Programming	2	1	2	-	-	-	-	25	25	50
7	231AIMLMDML201	MDM-1	Web Mining	2	2	-	-	20	-	30	-	-	50
8	231AIMLVECL201	VEC	Formal Automata and Applications	2	2	-	-	-	-	50	-	-	50
9	231AIMLOECL201	OEC-1	ODL only – Fundamentals of Python Programming	4	2§	-	-	20	30	50	25	-	125
10	231AIMLHSSML201	HSSM	Intellectual Property Rights and Management	2	2	-	-	20	30	-	-	-	50
11	231AIMLMCL201	MC	Finishing School Training III	Audit	3*	-	-	50*	-	-	-	-	Grade
12	231AIMLCCAP201	CCA	Liberal Learning	-	2*	-	-	50*	-	-	-	-	Grade
Total				22	17	6		120	150	230	100	75	675

* - Values not included in total

§ - Contact hours for online courses

Min. Marks for Passing: 40% of total marks of individual course



Teaching and Evaluation Scheme from Year 2024-25 (as per NEP 2020)

SEMESTER-IV													
Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/POE	
					L	P	T						
1	231AIMLPCCL204	PCC	Data Communication & Networking	3	3	-	-	20	30	50	-	-	100
2	231AIMLPCCL205	PCC	Computer Algorithms	3	3	-	-	20	30	50	-	-	100
3	231AIMLPCCL206	PCC	Operating System	2	2	-	-	20	30	-	-	-	50
4	231AIMLPCCP204	PCC	Data Communication & Networking Laboratory	1	-	2	-	-	-	-	25	-	25
5	231AIMLPCCP205	PCC	Computer Algorithms Laboratory	1	-	2	-	-	-	-	-	25	25
6	231AIMLMDML202	MDM-2	Data Handling with R Programming	2	2	-	-	20	-	30	-	-	50
7	231AIMLVECL202	VEC	Environmental Studies	2	2	-	-	-	-	50	-	-	50
8	231AIMLHSSML202	HSSM	Software Engineering and Project Management	2	1	2	-	20	30	-	-	-	50
9	231AIMLAEC201	AEC	AR-VR with Mini Project	2	1	2	-	-	-	-	25	25	50
10	231AIMLOECL202	OEC-2	Foundations of Artificial Intelligence	2	2	-	-	-	-	50	-	-	50
11	231AIMLVSECP201	VSEC	Web Technologies	2	1	2	-	-	-	-	25	25	50
12	231AIMLMCL202	MC	Finishing School Training IV	Audit	2*	-	-	50*	-	-	-	-	Grade
13	231AIMLCCAP202	CCA	Liberal Learning	-	2*	-	-	50*	-	-	-	-	Grade
Total				22	17	10	-	100	120	230	75	75	600

* - Values not included in total

Min. Marks for Passing: 40% of total marks of individual course



Course Plan

Course Title : Data Structures using C	
Course Code : 201AIMLPCCL201	Semester : III
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

Course Description:

This course will introduce the fundamentals of data structures and provide an understanding of how to systematically organize data in a computer system. Also, includes topics which focus on searching and sorting techniques, linked list, trees and graphs. This course is helpful in many areas of electrical engineering, computational biology, computational finance, etc. They are used in a variety of applications today, including search engines (e.g., Google, Bing), social networking applications (e.g. Facebook, Twitter), embedded systems (e.g., cell phones, robots), and DNA analysis.

Course Objectives:

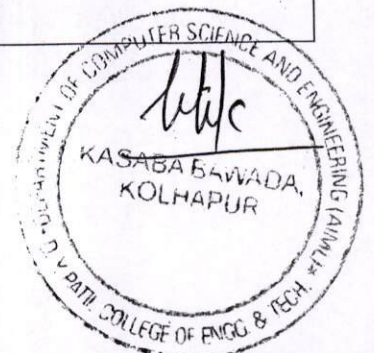
1. To make the students familiar with basic data structures
2. To select appropriate data structures in computer applications.
3. To provide the students with the details of implementation of various data structures.

Course Outcomes (COs):

At the end of the course, the student should be able to:

PCCL201.1	Understand the basic concepts and applications of data structures, as well as the algorithms that operate on them.
PCCL201.2	Compare various data structures, searching techniques, and sorting techniques and recognize their advantages and disadvantages.
PCCL201.3	Understand the details of the implementation of various data structures.
PCCL201.4	Select appropriate data structures, search and sort techniques in computer applications.

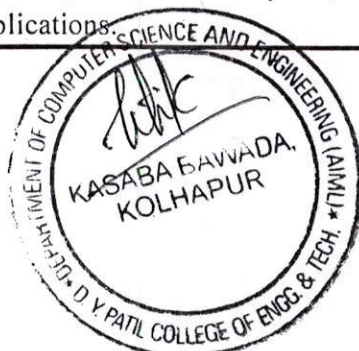
Prerequisite:	Basic knowledge of algorithms and C programming
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCL201.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL201.2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL201.3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL201.4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	3

Content	Hours
<p>Unit 1: Basic of Data Structures</p> <p>Concept and need of DS, Abstract Data Type, Data structure- Definition, Types of data structures, Operations on DS, Algorithm Complexity: i) Time, ii) Space complexity.</p>	7
<p>Unit 2: Searching and Sorting Techniques</p> <p>Linear search, Binary search, Sentinel search, Fibonacci search, Hashing – Definition, hash functions, Collision, Bubble sort, Selection sort, Insertion sort, two-way Merge sort, Quick sort, Radix sort, Tim sort, shell sort complexity, and analysis.</p>	8
<p>Unit 3: Stacks and Queues</p> <p>Stack: Definition, Stack representation in memory using array, stack as an ADT, Stack Operations and Conditions, applications of Stack: i) Reversing a list ii) Polish notations Queue: Definition, Array representation of queue, Queue as an ADT, Types of Queue: Linear Queue, Circular queue, Priority queue, Queue Operations and conditions, applications.</p>	8



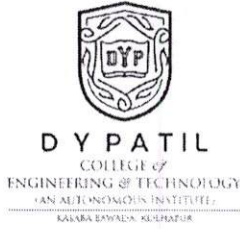
<p>Unit 4: Linked Lists</p> <p>Introduction to Linked List Terminologies, operations on linked list, Types of Linked List: Linear list, doubly and circular linked lists. Operations on Linked List, Linked representation of stack and Queue, Dynamic storage management, Memory efficient doubly linked list, unrolled Linked List, Skip List</p>	8
<p>Unit 5: Trees</p> <p>Tree Terminologies, Traversal Methods, Types of Trees: General tree, binary tree, binary search tree, Binary tree traversal: i) In order traversal, ii)preorder traversal, iii)Post order traversal, Expression tree, AVL search tree, B tree, B+ tree, Heaps- Operations and their applications, Heap sort</p>	8
<p>Unit 6: Graphs</p> <p>Basic concept of graph theory, storage representation and manipulation of graphs, graph traversal techniques- BFS and DFS, Introduction to sparse matrix, representation of sparse matrix using linked list, Transpose of sparse matrix.</p>	8

Text Books:

1. Seymour Lipschutz (MGH), Data Structures; McGraw Hill publications, Third Edition, [1 July 2017].
2. Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series, Data Structures and Algorithms [1983].
3. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python, CareerMonk Publication [2016].

Reference Books:

1. Jean-Paul Tremblay, Paul. G. Soresan, "An Introduction to Data Structures with Applications" - Tata Mc-Graw Hill International Editions, 2nd edition .
2. Richard F. Gilberg and Behrouz A., Data Structures- A Pseudo code Approach with C , 2nd Edition [15 Nov. 2007].
3. A. M. Tanenbaum, Y. Langsam, Data Structure using C; M. J. Augenstein, PHI publication, 2nd Edition, [1996].
4. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition



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S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- III (Academic Year-2024-25)

Online Resources:

NPTEL videos:

1. <https://nptel.ac.in/courses/106/102/106102064/>
2. www.oopweb.com/algorithms
3. www.studytonight.com/data-structures/
4. <http://www.academictutorials.com/data-structures>
5. <http://www.indiabix.com>
6. Liscs.wssu.edu





Course Plan

Course Title: Fundamentals of Artificial Intelligence	
Course Code: 231AIMLPCCL202	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: 2
Evaluation Scheme : ISE+MSE Marks: 20 + 30	ESE Marks : NA

Course Description:

AI is a part of computer science based on the theoretical and applied principles of that field. These principles include the data structures used in knowledge representation, the algorithms needed to apply that knowledge, and the languages and programming techniques used in their implementation.

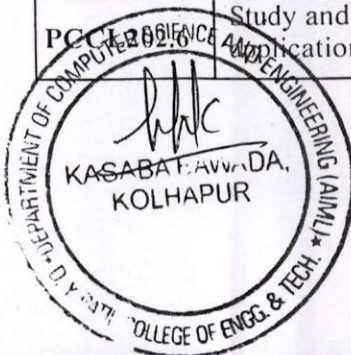
Course Objectives:

1. To familiarize students with Artificial Intelligence principles and techniques.
2. To introduce the facts of computational model and their applications.
3. To explore problem-solving paradigms, search methodologies and learning algorithms.
4. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

COs	
PCCL202.1	Characterize different types of AI environments, transform a given real world problem to state space problem, understand and identify the stages and issues in the development of an expert system.
PCCL202.2	Apply different searching algorithms and heuristic methodologies to reach the goal in state-space problems.
PCCL202.3	Use utility theory, including utility functions, value iteration, and policy iteration, in decision-making processes.
PCCL202.4	Distinguish between supervised, unsupervised, and reinforcement learning, and apply learning decision trees.
PCCL202.5	Apply various reinforcement learning algorithms such as passive reinforcement learning, Q-learning, and temporal difference learning.
PCCL202.6	Study and use important Python libraries like NumPy, SciPy, and matplotlib for AI applications.



Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCL202.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	L-2
PCCL202.2	2	3	3	-	-	-	-	-	-	-	-	-	2	-	L-3
PCCL202.3	2	1	2	-	-	-	-	-	-	-	-	-	2	-	L-2
PCCL202.4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	L-2
PCCL202.5	3	2	3	-	-	-	-	-	-	-	-	-	3	-	L-3
PCCL202.6	3	2	3	-	-	-	-	-	-	-	-	-	3	-	L-2

Prerequisite:	Knowledge of basic Computer Algorithms
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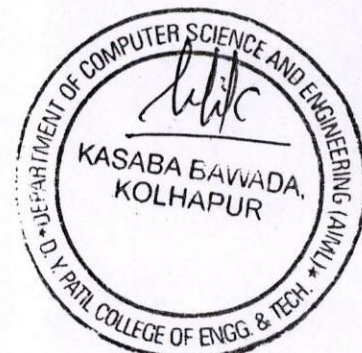
Content	Hours
Unit 1: Introduction Importance of AI, Evolution of AI, Application of AI, Classification of AI with respect to environment, Intelligent agents, Different type of agents, Expert Systems, Stages in the development of Expert Systems	5
Unit 2: Representation and Search Problem solving by search Problem space - State space, Blind Search - Types, Performance measurement. Types, Game playing mini-max algorithm, Alpha-Beta Pruning, Depth first search, Breadth first search.	5
Unit 3: Uncertainty management in rule based expert system Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction, and inference, temporal model, hidden Markov model. MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs	5
Unit 4: Learning Systems & Expert Systems Forms of Learning Types - Supervised, Unsupervised, Reinforcement Learning, and Learning Decision Trees. Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems - Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems	6
Unit 5: Reinforcement Learning Passive reinforcement learning, Direct utility estimation, Adaptive dynamic programming, Temporal difference learning, Active reinforcement learning- Q learning.	5
Unit 6: Machine Learning with python Study of important inbuilt libraries of Python like NumPy, SciPy, matplotlib, Installing Python. Setting up PATH. Running Python. Study of simple applications of AI with Python	4

Text Books:

1. Gorge F Luger, "Artificial Intelligence; structures and strategies for complex problem solving", Pearson Education, 5th Edition. [Units 1, 2, 3 &6]
2. Michael Negnevistsky, "Artificial Intelligence: A guide to intelligent systems", Person Education, 2nd edition. [Units 4, 5]
3. Giancarlo Zaccone, "Getting started with Tensor Flow", Packt Publishing, 2016. [Unit6].

Reference Books:

1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson Education India, 6 January 2015



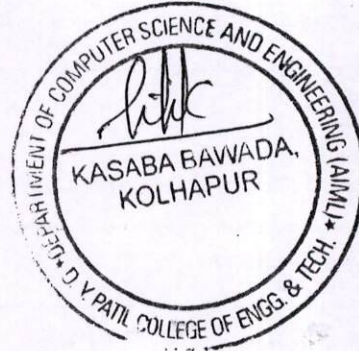


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KASABA BAWADA, KOLHAPUR-416006
(An Autonomous Institute) B. Tech. Curriculum
S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- III (Academic Year-2024-25)

Online Resources:

1. <https://nptel.ac.in/courses/106/102/106102220/>
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview



Course Plan

Course Title: Discrete Mathematics and Graph Theory	
Course Code: 231AIMLPCCCL203	Semester: III
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

Course Description:

The objective of this course is to teach students how to think logically and mathematically. The course stresses on mathematical reasoning and describes different ways in which mathematical problems could be solved. This course consists of concepts of Discrete Mathematical Structures such as Set Theory, Algebraic systems, Lattices & Probability. The course also aims to study of Graphs, their basics & applications.

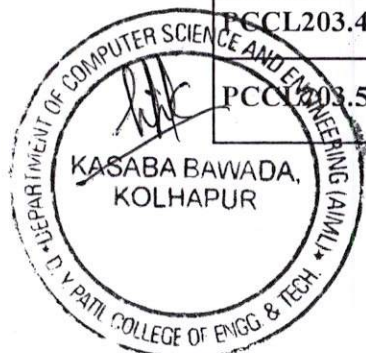
Course Objectives:

1. To develop logical thinking and its application to computer science.
2. To understand relations & functions.
3. To expose the students to the concepts of Lattices.
4. To introduce basic concepts of Graph and their Applications.
5. To understand the concepts of Permutations, Combinations, Probability & Discrete Random Variables.

Course Outcomes (COs):

At the end of the course, the student should be able to:

PCCL203.1	Write an argument using logical notation and determine if the argument is valid or invalid.
PCCL203.2	Identify different types of binary relations on the basis of their properties.
PCCL203.3	Identify the appropriate lattice and minimize the Boolean function.
PCCL203.4	Understand Graph Theory and apply it to computer science applications.
PCCL203.5	Solve the problems using permutations, combinations, and probability, & learn concepts of Discrete Random Variables.



Prerequisite:	Mathematics - Probability theory, Set theory.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCL203.1	2	-	1	-	-	-	-	-	-	-	-	1	-	-	5
PCCL203.2	2	-	-	-	-	-	-	-	-	-	-	1	1	-	3
PCCL203.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
PCCL203.4	2	-	-	-	1	-	-	-	-	-	-	-	2	-	3
PCCL203.5	2	-	-	-	-	-	-	-	-	-	-	1	-	-	3

Content	Hours
<p>Unit 1: Mathematical logic</p> <p>Statements and Notations, Connectives – negation, Conjunction, disjunction, conditional, bi-conditional, Statement formulas and truth tables, well -formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives, Normal and principal normal forms, completely parenthesized infix and polish notations, Theory of Inference for statement calculus – validity using truth table, rules of inference.</p>	9
<p>Unit 2: Binary Relations & Functions</p> <p>Relation and ordering - properties of binary relations in a set, relation matrix and the graph of a relation, Partition and Covering of Sets, Equivalence relations , Functions – types, composition of functions, Inverse Function</p>	9

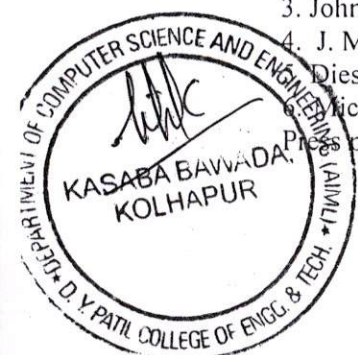
<p>Unit 3: Lattices and Boolean algebra Lattice as POSETs, definition, examples and properties, Lattices as algebraic systems, Special lattices. Boolean algebra definition and examples, Boolean functions, representation and minimization of Boolean functions.</p>	7
<p>Unit 4: Graphs & Matching's Introduction to Graph, Paths, Reachability and Connectedness, Matrix Representation, Storage representation and manipulation of Graphs, PERT and related Techniques, Euler's Formula, Euler and Hamilton Paths , Non-Hamiltonian Planar Graphs, Matching's and Coverings in Bipartite Graphs Perfect Matching's</p>	7
<p>Unit 5. Permutations, Combinations and Probability Theory Random Experiments, Sample space & Events, Pigeon hole principle, Permutations and Combinations, Concept of Probability Discrete Probability, Conditional Probability.</p>	7
<p>Unit 6: Discrete Random Variables & Expectation Random variables & expectations, linearity of Expectations, Jensen's Inequality, Bernoulli & Binomial Random Variables</p>	6

Text Books:

1. J. P. Tremblay & R. Manohar, "Discrete Mathematical Structures with Application to Computer Science", MGH International (Unit 1-3).
2. J. A. Bondy and U.S.R. Murty, "Graph Theory with Applications", North-Holland, 1976.(Unit 4).
3. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", SiE Edition, Tata McGraw-Hill, 2008, ISBN 10:0-07-066913-9. (Unit 5).
4. Michael Mitzenmacher, Eli Upfal, "Probability and Computing Randomized Algorithms & Probabilistic Analysis", Cambridge (Unit 6)

Reference Books:

1. Seymour Lipschutz, Marc Lipson, "Discrete Mathematics", MGH Schaum's outlines.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications" AT&T Bell Labs (mhhe.com/rosen).
3. John Schiller, Murray R. Spiegel, "Probability and Statistics" MGH, Schaum's outlines
4. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007
5. Diestel, R. Graph Theory, New York, NY: Springer-Verlag, 1997. ISBN: 3540261834.
6. Michael Baron, "Probability and Statistics for Computer Scientists", Second Edition, CRC Press publication



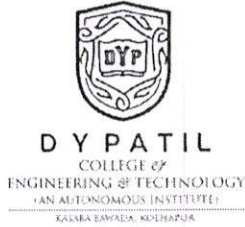


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Online Resources:

1. <https://nptel.ac.in/courses/111/107/111107058/>
2. <https://nptel.ac.in/courses/106/106/106106094/>
3. <https://nptel.ac.in/courses/106/106/106106183/>





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 S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- III (Academic Year-2024-25)

Course Plan

Course Title : Data Structures using C Laboratory	
Course Code : 201AIMLPCCP201	Semester : III
Teaching Scheme : L-T-P : 0-0-2	Credits : 1
Evaluation Scheme : ISE + MSE Marks : NA	INT - 25, POE - 25

Course Description:

This course will introduce the fundamentals of data structures and provide an understanding of how to systematically organize data in a computer system. Also, includes topics which focus on searching and sorting techniques, linked list, trees and graphs. This course is helpful in many areas of electrical engineering, computational biology, computational finance, etc. They are used in a variety of applications today, including search engines (e.g., Google, Bing), social networking applications (e.g. Facebook, Twitter), embedded systems (e.g., cell phones, robots), and DNA analysis.

Course Objectives:

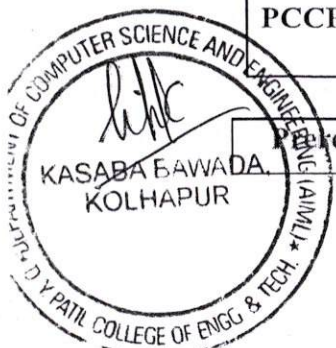
1. To make the students familiar with basic data structures
2. To select appropriate data structures in computer applications.
3. To provide the students with the details of implementation of various data structures.

Course Outcomes (COs):

At the end of the course, the student should be able to:

PCCP201.1	Understand the basic concepts and applications of data structures, as well as the algorithms that operate on them.
PCCP201.2	Compare various data structures, searching techniques, and sorting techniques and recognize their advantages and disadvantages.
PCCP201.3	Understand the details of the implementation of various data structures.
PCCP201.4	Select appropriate data structures, search and sort techniques in computer applications.

Prerequisite:	Basic knowledge of algorithms and C programming
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCP201.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCP201.2	-	2	-	2	1	-	-	-	-	-	-	-	-	-	2
PCCP201.3	3	-	-	2	1	-	-	-	-	-	-	-	-	-	2
PCCP201.4	3	3	-	2	1	-	-	-	-	-	-	-	1	-	3

List of Experiments			
Exp. No.	Name of Experiment	S/O	Hours
1	Implement a 'C' program for performing the following operations on Array: Creation, Insertion, Deletion, and display.	O	2
2	Implement a 'C' program to search a particular data from the given array using: (i) Linear Search, (ii) Binary Search	O	2
3	Implement a 'C' program to sort an array using the following methods: (i) Bubble sort, (ii) Selection sort, (iii) Insertion sort	O	2
4	Write a C program to perform PUSH and POP operations on stack using array.	O	2
5	Write a C program to perform INSERT and DELETE operations on a queue using an array.	O	2
6	Write a C Program to perform INSERT and DELETE operations on a Queue using array.	O	2
7	Write a 'C' program to implement STACK using QUEUE	O	2
8	Write a C Program to perform the operations (insert, delete) on the Singly Linked List	O	2
9	Write a C Program to perform the operations (traverse and search) on Singly Linked List	O	2

10	Write C Program to perform the operations (Insert, Delete , Traverse and search) on the Doubly Linked List	O	2
11	Write C Program to perform the operations (Insert, Delete) on Circular Singly Linked List	O	2
12	Write C Program to perform the operations (Traverse and search) on Circular Singly Linked List	O	2
13	Write C Program to implement BST (Binary Search Tree) and traverse the tree (Inorder, Preorder, Postorder)	O	2
14	Write a C Program to implement Graph representation	O	2
15	Case Study (Not limited to) - 1. Garbage Collection. 2. Priority queue in bandwidth management. 3. Null Terminated or cyclic node. 4. Use of sparse matrix in Social Networks and 5. Maps.	S	2

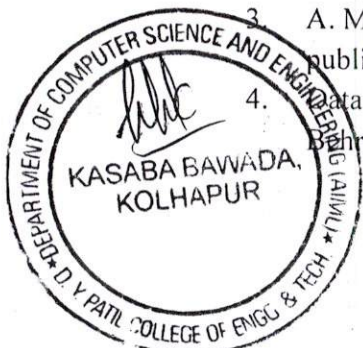
❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. Seymour Lipschutz (MGH), Data Structures; McGraw Hill publications, Third Edition, [1 July 2017].
2. Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series, Data Structures and Algorithms [1983].
3. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python, CareerMonk Publication [2016].

Reference Books:

1. Jean-Paul Tremblay, Paul. G. Soresan, "An Introduction to Data Structures with Applications" - Tata Mc-Graw Hill International Editions, 2nd edition .
2. Richard F. Gilberg and Behrouz A., Data Structures- A Pseudo code Approach with C , 2nd Edition [15 Nov. 2007].
3. A. M. Tanenbaum, Y. Langsam, Data Structure using C; M. J. Augenstein, PHI publication, 2nd Edition, [1996].
4. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition



Online Resources:

NPTEL videos:

1. <https://nptel.ac.in/courses/106/102/106102064/>
2. www.oopweb.com/algorithms
3. www.studytonight.com/data-structures/
4. <http://www.academictutorials.com/data-structures>
5. <http://www.indiabix.com>
6. Liscs.wssu.edu





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(An Autonomous Institute) B. Tech. Curriculum
S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- III (Academic Year-2024-25)

Course Plan

Course Title: Fundamentals of Artificial Intelligence Laboratory	
Course Code: 231AIMLPCCP202	Semester: III
Teaching Scheme: L-T-P: 0-0-2	Credits: 1
Evaluation Scheme : ISE+MSE Marks: NA	INT : 25 , POE : 25

Course Description:

AI is a part of computer science based on the theoretical and applied principles of that field. These principles include the data structures used in knowledge representation, the algorithms needed to apply that knowledge, and the languages and programming techniques used in their implementation.

Course Objectives:

1. To familiarize students with Artificial Intelligence principles and techniques.
2. To introduce the facts of computational model and their applications.
3. To explore problem-solving paradigms, search methodologies and learning algorithms.
4. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

COs	
PCCP202.1	Characterize different types of AI environments, transform a given real world problem to state space problem, understand and identify the stages and issues in the development of an expert system.
PCCP202.2	Apply different searching algorithms and heuristic methodologies to reach the goal in state-space problems.
PCCP202.3	Use utility theory, including utility functions, value iteration, and policy iteration, in decision-making processes.
PCCP202.4	Distinguish between supervised, unsupervised, and reinforcement learning, and apply learning decision trees.
PCCP202.5	Apply various reinforcement learning algorithms such as passive reinforcement learning, Q-learning, and temporal difference learning.
PCCP202.6	Study and use important Python libraries like NumPy, SciPy, and matplotlib for AI applications.



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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCP202.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	L-2
PCCP202.2	2	3	-	2	1	-	-	-	-	-	-	-	2	-	L-3
PCCP202.3	2	1	-	2	1	-	-	-	-	-	-	-	2	-	L-2
PCCP202.4	3	2	-	1	1	-	-	-	-	-	-	-	3	-	L-2
PCCP202.5	3	2	-	1	1	-	-	-	-	-	-	-	3	-	L-3
PCCP202.6	3	2	-	1	1	-	-	-	-	-	-	-	3	-	L-2

Prerequisite:	Knowledge of basic Computer Algorithms
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Exp. No.	Name of the Experiment	S/O	Hours
1	Study of Problem solving by Search and Problem space - State space	S	2
2	Study of uninformed and informed search	S	2
3	Study of construction of Bayesian network from given data	S	2
4	Implement Depth First Search (DFS)	O	2
5	Implement Breadth First Search (BFS)	O	2
6	Implement Min-Max Algorithm	O	2
7	Study of the development of a simple expert system	S	2
8	Study of Tic-Tac-Toe game using Python.	S	2
9	Perform basic mathematical and statistical operations using NumPy	O	2
10	Perform basic mathematical and statistical operations using SciPy.	O	2
11	Study of a program using Pandas Libraries	S	2
12	Understanding Machine Learning Concepts (Study Experiment)	O	2
13	Create various types of plots (line, scatter, and histogram) to analyze datasets.	O	2
14	Implement a basic AI application (e.g., a chatbot or recommendation system) using Python and its libraries.	O	2
15	Mini project on AI case studies	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

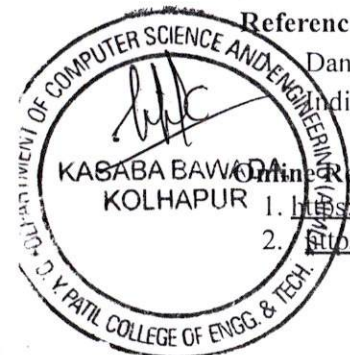
1. Gorge F Luger, "Artificial Intelligence; structures and strategies for complex problem solving", Pearson Education, 5th Edition. [Units 1, 2, 3 &6]
2. Michael Negnevistsky, "Artificial Intelligence: A guide to intelligent systems", Person Education, 2nd edition. [Units 4, 5]
3. Giancarlo Zaccane, "Getting started with Tensor Flow", Packt Publishing, 2016. [Unit6].

Reference Books:

Dan W. Patterson, Introduction to Artificial Intelligence, Pearson Education India, 6 January 2015

Online Resources:

1. <https://nptel.ac.in/courses/106/102/106102220/>
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview



Course Plan

Course Title: Introduction to OOPS & Java Programming	
Course Code: 231AIMLCEPP201	Semester: III
Teaching Scheme: L-T-P: 1-0-2	Credits: 2
Evaluation Scheme: ISE+MSE Marks: NA	INT + POE Marks: 25 + 25

Course Description:

This course provides an object-oriented approach using Java programming constructs. The course includes the basics of Java language programming, the different object-oriented features, interfaces, and packages. This course enables the students to develop the GUI based applications using advanced features such as Swing.

Course Objective:

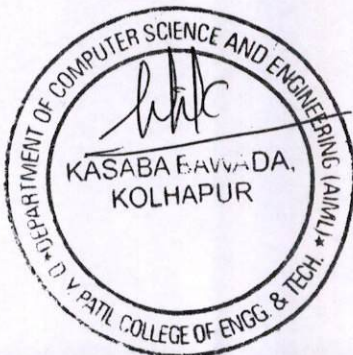
1. To introduce the concepts of object-oriented programming using Java programming constructs.
2. To expose the students to the Java concepts using inheritance.
3. To develop the problem-solving ability using interface, package, I/O and exception handling mechanisms.
4. To build the foundations of advanced Java programming for application development using the GUI design

Course Outcomes (COs):

At the end of the course, the student should be able to:

CEPP201.1	Use Java programming concepts for solving problems with object-oriented approach.
CEPP201.2	Develop a reliable and user –friendly application using inheritance and its types.
CEPP201.3	Develop problem-solving abilities using interface, package, I/O and exception handling mechanisms.
CEPP201.4	Create the applications using the GUI design components with the use of modern tools.

Prerequisite:	Basic knowledge of C programming and object-oriented programming.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

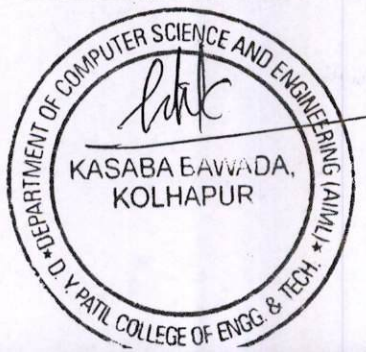
COs/ POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CEPP201.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CEPP201.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	3
CEPP201.3	2	2	3	-	1	-	-	-	2	-	-	-	2	-	3
CEPP201.4	3	2	2	-	1	-	-	-	2	-	-	-	1	-	3

Content	Hrs
Unit 1: Fundamental Programming in Java: The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Array. Introduction to Object Oriented Programming Paradigms: Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing Information to a Method or a Constructor, Creating and using objects, Controlling Access to Class Members, Static Fields and Methods, this keyword.	2
Unit 2: Inheritance and Its Types Inheritance: Definition, Super classes, and Sub classes, Overriding and Hiding Methods, Polymorphism, Inheritance Hierarchies, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Inner Classes, garbage collection.	3



<p>Unit 3: Interfaces and Packages</p> <p>Interfaces: Defining an Interface, implementing an Interface, using an Interface as a Type, Evolving Interfaces, and Default Methods.</p> <p>Packages: Class importing, creating a Package, naming a Package, Using Package Members, Managing Source and Class Files.</p>	3
<p>Unit 4: Exception</p> <p>Exception: Definition, dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, finally clause.</p>	3
<p>Unit 5: I/O Streams</p> <p>Byte Stream–Input Stream, Output Stream, DataInputStream, DataOutputStream, FileInputStream, FileOutputStream, CharacterStreams, BufferedStream, Scanner class options, Catching Multiple Exceptions, Re-throwing and Chaining</p>	2
<p>Unit 6: Graphical User Interfaces using AWT and Swing</p> <p>Introduction to AWT: components, Frame, Applet, Introduction to the Swing, Swing components. Layout Management: Introduction to Layout Management, APIs for Border Layout, Flow Layout, Grid Layout, Event Handling: Basics of Event Handling, The AWT Event Hierarchy, Semantic and Low-Level Events in the AWT, Low-Level Event Types</p>	2

List of Experiments			
Exp. No.	Name of Experiment	S/O	Hrs
1	Study of JAVA basics.	S	2
2	Implementation of a program using classes and objects.	O	2
3	Design and develop the programs for different types of Inheritance	O	2



4	Implementation of stack/queue operations using Interface	O	2
5	Implement program using function overloading.	O	2
6	Create abstract classes and methods, and implement them in subclasses.	O	2
7	Write a program to illustrate polymorphism through method overriding.	O	2
8	Implementation of user defined package.	O	2
9	Implementation of any type of exception handling	O	2
10	Implementation of different I/O operations using console and file.	O	2
11	Implementation of program for designing the GUI using swing components.	O	2
12	Implementation of a program to demonstrate layout managers.	O	2
13	Implementation of different types of event handling.	O	2
14	Design an application using any modern tools available for java programming , such as Eclipse IDE , NetBeans, Oracle JDeveloper, IntelliJ, etc.	O	2
15	Mini-Project	O	2

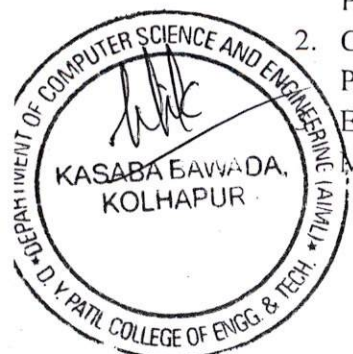
❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. Herbert Schildt, JAVA- The Complete Reference, McGraw Hill, Ninth Edition.

Reference Books:

1. Cay Horstmann and Gary Cornell, Core Java - Volume I Fundamentals, Pearson, 8th edition .
 2. Cay Horstmann and Gary Cornell, CoreJava -Volume II Advanced Features, Pearson, 8th edition.
- E. Balaguruswamy, Object-Oriented Programming with C++, Tata McGraw-Hill, 6th Edition





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S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)

SEM- III (Academic Year-2024-25)

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. <https://java-iiitd.vlabs.ac.in/List%20of%20experiments.html>
3. Virtual Lab - <http://cse02-iiith.vlabs.ac.in/>



Course Plan

Course Title: MDM-1 - Web Mining	
Course Code: 231AIMLMDML201	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: 2
Evaluation Scheme : ISE Marks : 20	ESE Marks: 30

Course Description:

This course focuses on extracting knowledge from the web by applying Machine Learning techniques for classification and clustering of hypertext documents. Basic approaches from the area of Information Retrieval and text analysis are also discussed.

Course Objectives:

1. To introduce students to the basic concepts and techniques of Information Retrieval, Web Search, Data Mining.
2. To understand the whole process of collecting information from the web.
3. To study Machine Learning for extracting knowledge from the web.
4. To gain experience doing independent study and research.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

COs	
MDML201.1	Introduce students to the basic concepts and techniques of Information Retrieval, Web Search, Data Mining.
MDML201.2	Understand the whole process of collecting information from the web.
MDML201.3	Study Machine Learning for extracting knowledge from the web.
MDML201.4	Gain experience of doing independent study and research.

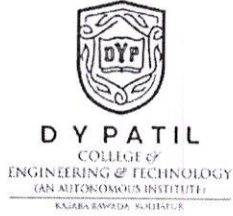
Prerequisite:	Basic knowledge of algebra, discrete math and statistics
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
MDML201.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	L-2
MDML201.2	2	3	3	-	-	-	-	-	-	-	-	-	2	-	L-3
MDML201.3	2	1	2	-	-	-	-	-	-	-	-	-	2	-	L-3
MDML201.4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	L-3

Content	Hours
Unit 1: Introduction Crawling and Indexing , Topic Directories , Clustering and Classification , Hyperlink Analysis , Resource Discovery and vertical portals , Structured vs. Unstructured Data mining.	5
Unit 2: Crawling the Web HTML and HTTP Basics , Crawling Basics , Engineering Large-Scale Crawlers , Putting together a Crawler.	5
Unit 3: Web Search and Information Retrieval Boolean queries and the Inverted Index : Stopwords and Stemming , Batch Indexing and Updates , Index Compression Techniques. Relevance Ranking : Recall and Precision , The vector space model.	5
Unit 4: Similarity Search Handling "Find- Similar" Queries , Eliminating Near Duplicates via Shingling , Detecting locally Similar Subgraphs of the Web , Formulations and Approaches .	5
Unit 5: Similarity and Clustering Agglomerative Clustering , The K-Means Algorithm , Clustering and Visualization via Embeddings : Self-Organizing Maps (SOMs) , Multidimensional Scaling (MDS) and FastMap , Projections and Subspaces , Latent Semantic Indexing (LSI)	5
Unit 6: The Future of Web Mining Information Extraction , Natural Language Processing : Lexical Networks and Ontologies , Part-of-Speech and Sense Tagging , Parsing and Knowledge Representation	5



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SEM- III (Academic Year-2024-25)

Text Books:

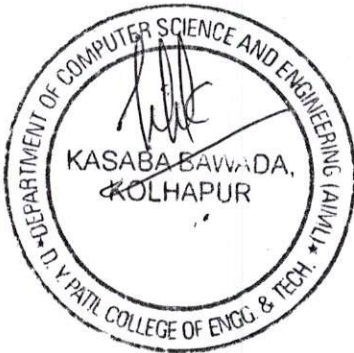
1. Soumen Chakrabarti , “Mining the Web :Discovery Knowledge From Hypertext Data”, Morgan Kaufmann Publishers. [All Units]

Reference Books:

1. Bing Liu , “Web Data Exploring Hyperlinks, Contents, and Usage Data “ , Springer , Second Edition.

Online Resources:

1. https://books.google.com.na/books?id=5Zxw1h6vc_UC&printsec=frontcover#v=onepage&q&f=false
2. <chrome-extension://oemmndcbldboiebfnladdacbfmadadm/https://tjzhifei.github.io/links/WDM2.pdf>



Course Plan

Course Title: Formal Automata and Applications	
Course Code: 231AIMLVECL201	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: 2
Evaluation Scheme: ISE + MSE Marks: NA	ESE Marks: 50

Course Description:

The course introduces some fundamental concepts in automata theory, including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, etc. Formal systems and Automata is important because they allow scientists to understand how machines solve problems. Automata theory is an exciting, theoretical branch of computer science. Learning how to design automata helps to improve the logical thinking capability of the student.

Course Objectives:

1. To expose the students to the mathematical foundations of computation, the theory of formal languages and grammar.
2. To analyze and design finite automata, pushdown automata, grammar for formal languages & Turing machines, along with their applications.
3. To strengthen the students' ability to carry out formal and higher studies in computer science.

Course Outcomes (COs):

At the end of the course, the student should be able to:

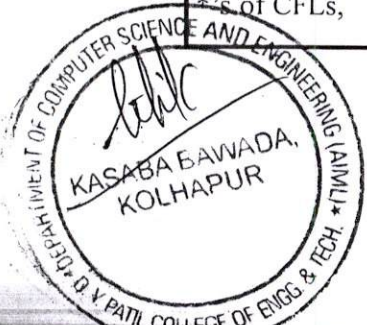
VECL201.1	Understand the concept of abstract machines and their power to recognize the languages.
VECL201.2	Design context free grammars for formal languages and simplify using normal forms and design parsers
VECL201.3	Understand the concepts of push down automata and properties of RL and CFL
VECL201.4	Design the computational and acceptor machines using FA, PDA and Turing machines

Prerequisite:	Discrete Mathematics, Sets, Cartesian Product and Functions
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BT L	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
VECL201.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
VECL201.2	-	1	1	-	-	-	-	-	-	-	-	1	-	-	-	3
VECL201.3	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3
VECL201.4	2	2	2	-	-	-	-	-	-	-	-	1	2	-	-	3

Content	Hours
<p>Unit 1 : Mathematical Induction & Finite Automata</p> <p>Mathematical Preliminaries with basic concepts of languages, Inductive proofs, Recursive Definitions, Finite automata-definition and representation, Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), NFA with null transitions, Equivalence of FA's , NFA's and NFA's with null transitions.</p>	6
<p>Unit 2 : Regular languages and Regular Expressions</p> <p>Regular expressions and corresponding regular languages, examples and applications, unions, intersections & complements of regular languages, The Pumping Lemma for Regular Languages, Kleene's Theorem: Part I & II statements and proofs.</p>	6
<p>Unit 3 : Context Free Grammars and Languages</p> <p>Context-Free Grammars: Definitions, Examples, Derivation and ambiguity, converting a CFG to CNF, The Pumping Lemma for Context-Free Languages examples, Intersections and Complements of CFLs, intersections and complements, Union, Concatenation and *'s of CFLs,</p>	6



<p>Unit 4 : Pushdown Automata Definitions and Examples, Deterministic Pushdown Automata & types of acceptance, Equivalence of CFG's & PDA's PDA, NPDA, Equivalence of CFG's & PDA's, Top-down parsing, Bottom-up parsing.</p>	6
<p>Unit 5 : Turing Machines Definition, TM as language acceptors, Computing partial function with a TM, Variants of TM, Applications of Turing Machine.</p>	6

Text Books:

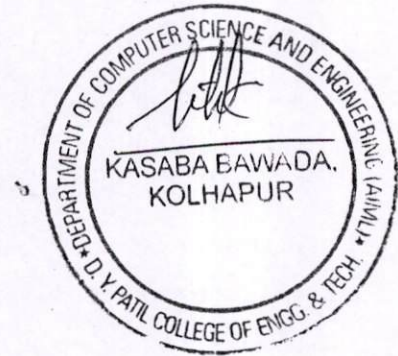
1. John C. Martin, Introduction to Languages & the Theory of Computations - (Tata MGH 3rd Edition) (Unit 1 to 5)
2. Michael Mitzenmacher, Eli Upfal Probability and Computing Randomized Algorithms & Probabilistic Analysis (Cambridge) (Unit 6)

Reference Books:

1. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 2nd edition, PHI.
2. Michael Sipser, Introduction to theory of Computations - (Thomson Books/Cole)
3. VivekKulkarni, Theory of Computation

Online Resources:

1. <https://nptel.ac.in/courses/111/103/111103016/>
2. <https://nptel.ac.in/courses/106/106/106106049/>
3. <https://automatonsimulator.com/>





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SEM- III (Academic Year-2024-25)

Course Plan

Course Title: OEC-I - Fundamentals of Python Programming	
Course Code: 231AIMLOECL201	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: 4
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50, INT - 25

Course Description:

The course shows you how to use free open-source Python to write basic programs and high-level applications using concepts such as data structures, packages, functions, variables, If Else statements, For loops, while loops, iterative and recursive programs, and algorithms. Python language is best fit for machine learning and neural networks, which includes access to great libraries and frameworks for AI and machine learning (ML). This course will be of great interest to all the students who would like to gain a thorough knowledge and understanding of the basic components of computer programming using the Python language.

Course Objectives:

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs. To develop Python programs with conditionals and loops.
3. To use Python libraries for Machine Learning & Neural network.
4. To define Python functions and call them.
5. To use Python data structures – lists, tuples, and dictionaries.



Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

OECL201.1	Develop algorithmic solutions to simple computational problems Read, write, execute simple Python programs.
OECL201.2	Structure simple Python programs for solving problems.
OECL201.3	Design a simple Machine Learning & Neural Network model using python libraries.
OECL201.4	Decompose a Python program into functions.
OECL201.5	Represent compound data using Python lists, tuples, and dictionaries.
OECL201.6	Read and write data from/to files in Python programs.

Prerequisite	Object Oriented Programming.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
OECL201.1			3	1				1								3
OECL201.2	3		1		2											2
OECL201.3		2	1		1											4
OECL201.4	1		3													2
OECL201.5		3		1												2
OECL201.6	1		3													3

Content	Hours
<p>Unit 1: Introduction & Hands On to Python Programming</p> <p>Introduction- Introduction to programming, algorithms, Pseudocode & Flow chart, History of Python, Features of Python, Basic Structure of Python Program. Downloading and installing Python, run a simple program on Python interpreter. Jupyter, Anaconda, Google Collaboratory.</p>	5
<p>Unit 2: Variables & Expressions</p> <p>Basics of Python Programming- Python variables, keywords, literals, data types, operators & expressions, precedence of operators, expressions, and comments; managing input output operations.</p>	5
<p>Unit 3: Control Flow</p> <p>Decision making & Branching- if, if-else, nested, elif.</p> <p>Decision Making & Looping - while, for, nested loop, break, continue, pass, Illustrative Problems for branching & looping- Palindrome, Strong & Armstrong number.</p>	5
<p>Unit 4: List, Tuples and Dictionaries</p> <p>Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters;</p> <p>Tuples: tuple assignment, tuple operations, tuple as return value;</p> <p>Dictionaries: Basic operations and methods, sorting items, nested dictionaries, advanced list processing – list comprehension; Illustrative programs:</p>	5
<p>Unit 5: Functions & String</p> <p>Functions: function definition, function call, more on defining functions, recursive functions, optional arguments, default values, Passing functions as arguments.</p> <p>Strings: Introduction, built-in string methods and functions, slice operation, immutability, string functions and methods; Illustrative programs: square root, gcd, sum an array of numbers, linear search.</p>	5
<p>Unit 6: Files & Exceptions</p> <p>Files: reading and writing files, format operator; command line arguments</p> <p>Exceptions- errors and exceptions, handling exceptions, Built-in and user-defined modules, packages; Illustrative programs: word count, copy file.</p>	5



Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books:

1. John V Guttag, Introduction to Computation and Programming Using Python“, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

Online Resources:

1. <https://nptel.ac.in/courses/106106145>



Course Plan

Course Title : Intellectual Property Rights and Management	
Course Code :231AIMLHSSML201	Semester : III
Teaching Scheme : L-T-P : 2-0-0	Credits : 2
Evaluation Scheme : ISE+MSE Marks : 25+30	ESE Marks : NA

Course Description:

This course introduces the student to the basics of Article writing, Publishing, Intellectual Property Rights, Copyright Laws, Trade Marks and issues related to Patents. The overall idea of the course is to help and encourage the students for Research, startups and innovations.

Course Objectives:

1. Understanding, defining, and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
2. Recognize the crucial role of IP in organizations in different industrial sectors for the purposes of product and technology development.
3. Impart knowledge on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

HSSML201.1	Define the importance of Intellectual Property Rights.
HSSML201.2	Use knowledge of Article writing, Searching, filling and drafting of Patents.
HSSML201.3	Understand the Copyright and apply it
HSSML201.4	Analyze the Trade Mark & Trade Secret.

Prerequisite: Basics of Intellectual Property Rights



Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
HSSML201.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	1
HSSML201.2	-	-	-	-	-	-	-	2	-	2	-	1	-	2	2
HSSML201.3	-	-	-	-	-	-	-	2	2	-	2	1	-	-	2
HSSML201.4	-	-	-	-	-	-	-	-	2	-	2	1	-	-	4

Content	Hours
<p>Unit 1: Introduction</p> <p>Intellectual Property Law Basics, Types of Intellectual Property, Agencies Responsible for Intellectual Property Registration, International Organizations, Agencies, and Treaties, The Increasing Importance of Intellectual Property Rights</p>	5
<p>Unit 2: Research Article Writing</p> <p>Select a relevant research topic, conduct a thorough literature review, and formulate clear research questions and hypotheses. Crafting compelling introductions and literature reviews, describing research methodologies in detail, and presenting results using appropriate tables, figures, and charts.</p>	5
<p>Unit 3: Research Analysis and Article Publishing</p> <p>Writing discussions that interpret findings, compare them with existing research, and highlight implications and limitations. Proper citation practices and reference management. Choosing the right journal, preparing manuscripts for submission, understanding the peer review process, and promoting published research.</p>	6
<p>Unit 3: Patents and Patent Draft writing</p> <p>Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models,</p>	5

Software Patenting and protection, Case studies- Apple Vs Samsung, Enfish LLC Vs Microsoft, Overview of Patent search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Effective patent management	
Unit 5 :Copyrights writing and Publishing Fundamentals of copyright, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, notice of copyright, Copyright writing and Publishing, Managing copyrights	5
Unit 6: Trade Marks Introduction, Purpose and Function of Trademarks, Types of Marks: Trademarks, Service Marks, Certification Marks, and Collective Marks, The Trademark Search, The Trademark Registration process and trademark management	4

Text Books:

1. Intellectual property -the law of trademarks , copyrights, patents and trade secrets by Deborah E. Bouchoux, fourth edition (unit 1 and 4)
2. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property, Eastern Book Company.

Reference Books:

1. M. M. S. Karki , Intellectual Property Rights: Basic Concepts, Atlantic Publishers
2. Neeraj Pandey & Khushdeep Dharni, Intellectual Property Rights, Phi Learning Pvt. Ltd
3. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications, Macmillan India Ltd
4. B. L. Wadehra, Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India
5. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Online Resources:

1. https://mrcet.com/downloads/digital_notes/CSE/II%20Year/INTELLECTUAL%20PROPERTY%20RIGHTS-NOTES.pdf
2. https://mitmecsept.files.wordpress.com/2018/10/deborah_ebouchoux_intellectual_property_the_bookzz-org.pdf
3. <https://www.wipo.int/about-ip/en/>
4. https://www.wto.org/english/tratop_e/trips_e/intell_e.htm



Course Plan

Course Title: Data Communication & Networking	
Course Code: 231AIMLPCCL204	Semester: IV
Teaching Scheme: L-T-P:3-0-0	Credits: 3
Evaluation Scheme : ISE : 20, MSE : 30	ESE : 50

Course Description:

This course provides a comprehensive introduction to computer networks and networking aspects, which will be of help to all Computer Science Engineering streams. The course includes computer networking fundamentals, network layered architectures, a descriptive study of different layers of networking models, and network protocols and tools.

Course Objectives:

1. To perceive fundamental concepts of computer networks.
2. To understand layered architecture and basic networking protocols.
3. To understand the client server model & socket interface.

Course Outcomes:

Upon successful completion of this course, the student will be able to –

PCCL204.1	Describe the concepts of Computer Networks and Network layered architecture.
PCCL204.2	Understand the protocols, algorithms and the addressing model used in networking.
PCCL204.3	Demonstrate different networking protocols using socket programming.
PCCL204.4	Understand the functionality of Domain Name System in networking.

Prerequisite	Basic knowledge of computers
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
PCCL204.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL204.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL204.3	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-	3
PCCL204.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
<p>Unit 1: Introduction to Computer Network:</p> <p>Overview of OSI layer Model and TCP/IP protocol model, Addressing, Underlying technologies for LANs, WANs, and Switched WANs</p>	6
<p>Unit 2: Data Link Layer:</p> <p>Design issues for Data Link Layers, framing methods, Error control: detection and correction, Flow control, Elementary Data Link protocols, Sliding window protocols Go back n, Selective repeat.</p>	8
<p>Unit 3: Network Addressing:</p> <p>IPv4 Addresses: Classful Addressing Other Issues, Sub-netting and Super netting, Classless Addressing, Delivery, Forwarding, and routing. IPv4: Datagram, Fragmentation, Options, Checksum. IPv6 Addressing: Introduction, IPv6 packet format: Base Header, Flow Label, Extension Headers, Transition from IPV4 to IPV6, Comparison between IPv4 and IPv6.</p>	8
<p>Unit 4: Routing and Congestion Control Techniques:</p> <p>Routing methods: shortest path, link state, distance vector routing and broadcast routing, congestion control algorithms: principles, congestion prevention policies, congestion control in the datagram subnet.</p>	8



<p>Unit 5: Transport Layer: The Transport service primitives, UDP: Process to Process communication, User Datagram Format, Operation and uses of UDP.TCP: TCP Services and Features, TCP segment format, TCP Connections.</p>	7
<p>Unit 6: Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, Web Caching. FTP, TFTP. DNS—The Internet’s Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages. DHCP. Telnet. Socket Programming: Socket Programming with UDP, Socket Programming with TCP.</p>	8

❖ S-STUDY, O-OPERATIONAL

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suit, Tata Mag.Hill,4th Ed.[Unit 1– 5].
2. Kurose James F., Ross Keith W., Computer Networking: A Top-Down Approach, Sixth Edition, By Pearson. [Unit 6].

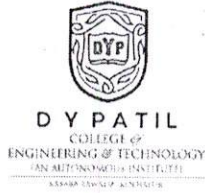
Reference Books:

1. Peter LDordal, An Introduction to Computer Networks, Release 1.9.15.
2. Andrew S.Tanenbaum (PHI), Computer Networks
3. W.Richard Stevens (PHI),Unix Network Programming

Online Resources:

1. <https://nptel.ac.in/courses/106/104/106104019>
2. <https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFI-O29szi>
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D.Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY,
KASABA BAWADA, KOLHAPUR-416006
 (An Autonomous Institute) B. Tech. Curriculum
 S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- IV (Academic Year-2024-25)

Course Plan

Course Title : Computer Algorithms	
Course Code:231AIMLPCCL205	Semester: IV
Teaching Scheme: L-T-P:3-0-0	Credit:3
Evaluation Scheme: ISE:20, MSE Marks: 30	ESE Marks:50

Course Description:

This course introduces basic methods for designing and analyzing efficient algorithms. Different algorithms for a given computational task are presented and their relative merits are evaluated based on performance measures. It introduces the fundamental techniques for designing and analyzing algorithms, including asymptotic analysis, divide-and-conquer algorithms, greedy algorithms, dynamic programming, traversal methods, and even a backtracking approach. It also provides an introduction to NP-completeness.

Course Objectives:

1. To introduce algorithm design methods/techniques with analysis.
2. To devise algorithm for given problem statement and compute its complexity.
3. To introduce complex computational problems

Course Outcomes:

Upon successful completion of the course, student will be able to...

COs	Course Outcomes
PCCL205.1	Understand and demonstrate algorithm design methods with analysis
PCCL205.2	Devise algorithm for given problem statement and analyze its space and time complexity by using recurrence relation
PCCL205.3	Categorize the problem to determine polynomial and non-polynomial based on its Nature.

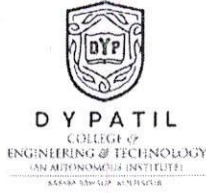
Prerequisite:	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts.
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Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs										PSOs		BTL		
	1	2	3	4	5	6	7	8	9	10	11	12			
PCCL205.1	2	2	1	-	-	-	-	-	-	-	-	-	-	-	3
PCCL205.2	3	1	2	-	-	-	-	-	-	-	-	-	2	-	3
PCCL205.3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	4

Contents	Hrs
<p>Unit 1: Divide and Conquer: What is an algorithm, Algorithm Specification, Recurrence relations, Performance Analysis, Randomized Algorithms, Divide and Conquer: The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, DC Selection Algorithm, Analysis of Divide and Conquer algorithms.</p>	10
<p>Unit 2: The Greedy Method: The general method, Knapsack problem, Job sequencing With deadlines, minimum-cost spanning trees–Prim’s and Kruskal’s Algorithms, Optimal storage on tapes, Optimal merge Patterns, and Single source shortest paths.</p>	08
<p>Unit 3: Dynamic Programming: The general method, Multistage graphs, All pair Shortest paths, 0/1 knapsack, Reliability design, Traveling Salesperson problem.</p>	06
<p>Unit 4: Basic Traversal and Search Techniques: Techniques for Binary Trees, Game Tree; Techniques for Graphs – Breadth-First Search & Traversal, Depth First Search & Traversal, AND/OR graphs; Connected components and Spanning Trees; Bi-connected Components and depth-first search.</p>	08



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SEM- IV (Academic Year-2024-25)

Unit 5: Backtracking: The general method, 8-queen problem, Sum of subsets, Knapsack Problem, Hamiltonian Cycle, and Graph Coloring. String Algorithms: Introduction, String Matching Algorithm, Brute Force Method, Robin-Karp String Matching algorithm, String Matching with Finite Automata	08
Unit 6: NP Hard and NP-Complete Problems: Basic Concepts, Polynomial and Exponential Problems, Introduction to NP-Complete and NP-Hard Graph Problems.	05

Text Books:

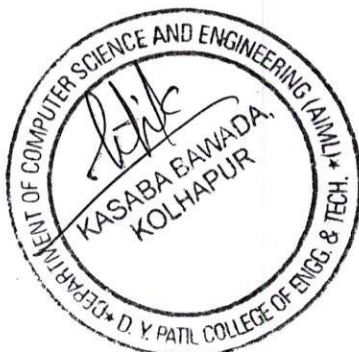
1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasekaran University Press, Second Edition (All Units)

Reference Books:

1. Data Structures and Algorithmic Thinking with PYTHON (Data Structure and Algorithmic Puzzles) Narasimha Karumanchi (MTech IIT Bombay) Career Monk Publications (Refer for String Algorithms in unit 5)
2. Fundamentals of Algorithms Gilles Brassard, Paul Bratley, Pearson Education.
3. Mastering Algorithms with C Kyle Loudon SPDO'Reilly.
4. Computer Algorithms-Introduction to Design and Analysis Sara Baase, Allen Van Gelder, Pearson Education.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms," Third Edition PHI 2010.

Online Resources:

1. <https://nptel.ac.in/courses/106/104/106104019>
2. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYF1-O29szjTrs_Q



Course Plan

Course Title : Operating System	
Course Code : 231AIMLPCCL206	Semester : IV
Teaching Scheme : L-T-P : 2-0-0	Credits : 2
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : NA

Course Description:

This course provides comprehensive overview of computer operating systems. It covers the foundation components, classical internal algorithms and structures of operating systems, including process scheduling, memory management and IO management.

Course Objectives:

1. To learn the basic concepts of operating systems, services, and operations in the operating system.
2. To expose the students to various functions of the operating system and their usage.
3. To make the students understand process management, memory management, and I/O device management.
4. To provide knowledge to the students about the fundamental architecture of UNIX and operating system kernel.

Course Outcomes (COs):

At the end of the course, the student should be able to:

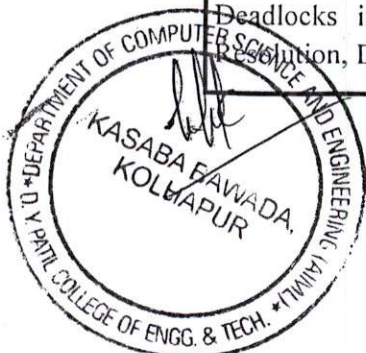
PCCL206.1	Understand the structure, functions, and services of an operating system.
PCCL206.2	Describe the methods of process management, process synchronization, and deadlocks.
PCCL206.3	Demonstrate the various memory management and I/O management techniques for effective execution of programs.
PCCL206.4	Analyze the process scheduling, memory management, and I/O management techniques.

Prerequisite:	Fundamental knowledge of computer, C programming, Data Structure
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCL206.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL206.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
PCCL206.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCL206.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	4

Content	Hours
<p>Unit 1: Introduction</p> <p>Evolution of operating systems, Types of operating systems, Different views of the operating system, The journey of a command execution, Overview of design and implementation of operating systems.</p>	5
<p>Unit 2: Process Management & Synchronization</p> <p>Process Concept, Operations on Processes, Interprocess Communication, Threads, Process Synchronization - Race Conditions, Critical Sections, Synchronization Approaches, Classic Process Synchronization Problems, Semaphores, Monitors.</p>	5
<p>Unit 3: Process Scheduling & Deadlock</p> <p>Scheduling Terminology and Concepts, Nonpreemptive Scheduling Policies, Preemptive Scheduling Policies, Process Scheduling- Case Studies, Deadlocks - Deadlocks in Resource Allocation, Handling Deadlocks, Deadlock Detection and Prevention, Deadlock Prevention, Deadlock Avoidance.</p>	5



<p>Unit 4: Memory Management</p> <p>Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Virtual Memory-Demand Paging, Page Replacement Policies.</p>	5
<p>Unit 5: File Systems and I/O Management</p> <p>Overview of File Processing, Files and File Operations, Fundamental File Organizations and Access Methods, Directories, Layers of the Input-Output Control System, Overview of I/O Organization, I/O Devices, and Device Drivers.</p>	5
<p>Unit 6: Unix Operating System (Case Study)</p> <p>System structure, User perspective, Architecture of the UNIX operating system, Introduction to system concepts, Kernel data structures, system administration, System calls for the file system-introduction, Network based operating systems.</p>	5

Text Books:

1. Milan Milenkovic, Operating systems concepts and design, McGRAW-Hill, 2nd edition.[Unit 1]
2. Silberschatz, Galvin, Gagne, Operating system concept, Wiley India, 8th edition.[Unit 2, 6]
3. Dhananjay M Dhamdhare, Operating systems - A Concept Based approach, Mc-Graw Hill, 3rd Edition. [Unit 3 to 5]
4. Maurice J. Bach, The design of Unix Operating System, PHI [Unit 6]

Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles, Pearson, 7th edition
2. Andrew S. Tanenbaum, Modern Operating Systems, Pearson Education International, 4th edition.
3. Achyut S. Godbole, Operating System with Case Studies in UNIX, Netware and Windows NT, TMGH.

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105214/#>
2. <https://nptel.ac.in/courses/106/102/106102132/>
3. <https://www.cse.iitb.ac.in/~mythili/os/>



Course Plan

Course Title: Data Communication & Networking Laboratory	
Course Code: 231AIMLPCCP204	Semester: IV
Teaching Scheme: L-T-P:0-0-2	Credits: 1
Evaluation Scheme : ISE + MSE : NA	INT : 25

Course Description:

This course provides a comprehensive introduction to computer networks and networking aspects, which will be of help to all Computer Science Engineering streams. The course includes computer networking fundamentals, network layered architectures, a descriptive study of different layers of networking models, and network protocols and tools.

Course Objectives:

1. To perceive fundamental concepts of computer networks.
2. To understand layered architecture and basic networking protocols.
3. To understand the client server model & socket interface.

Course Outcomes:

Upon successful completion of this course, the student will be able to –

PCCP204.1	Describe the concepts of Computer Networks and Network layered architecture.
PCCP204.2	Understand the protocols, algorithms and the addressing model used in networking.
PCCP204.3	Demonstrate different networking protocols using socket programming.
PCCP204.4	Understand the functionality of Domain Name System in networking.

Prerequisite	Basic knowledge of computers
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCP204.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
PCCP204.2	2	-	-	1	1	-	-	-	-	-	-	-	-	-	2
PCCP204.3	3	2	2	2	1	-	-	-	-	-	-	-	1	-	3
PCCP204.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Exp. No.	Name of the Experiment	S/O	Hours
1	Study of various Computer Networking models and connectivity devices.	O	2
2	Implementation of cross-wired cable and straight through cable using Crimping tool.	O	2
3	Study of IP address configuration & following connectivity test tools with All its options-ifconfig, arp, traceroute, nmap, netstat, finger.	O	2
4	Implementing Framing method : Bit Stuffing	O	2
5	Implementing Elementary data link protocol (Stop & wait protocol)	O	2
6	Implementation of Error detection Code (CRC)	O	2
7	Implementation of Error detection Code (Hamming)	O	2
8	Implementation of sliding window protocol.	O	2
9	Implement the routing algorithm (anyone).	O	2
10	Implementation of Link state Routing Algorithm	O	2
11	Implementation of Distance vector routing Algorithm	O	2
12	Programs for connection oriented(TCP)client- server using socket programming	O	2



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SEM- IV (Academic Year-2024-25)

13	Programs for connection less (UDP) client-server using socket programming	O	2
14	Study of following DNS Tools with all its options. nslookup, dig, host, who is.	O	2
15	Study of network protocol analyzer (Wire-Shark) and understanding packet	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

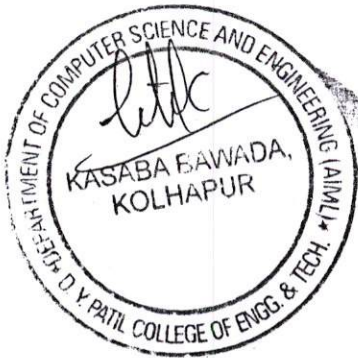
1. Behrouz A. Forouzan, TCP/IP Protocol Suit, Tata Mag.Hill,4th Ed.[Unit 1– 5].
2. Kurose James F., Ross Keith W., Computer Networking: A Top-Down Approach, Sixth Edition, By Pearson. [Unit 6].

Reference Books:

1. Peter LDordal, An Introduction to Computer Networks, Release 1.9.15.
2. Andrew S.Tanenbaum (PHI), Computer Networks
3. W.Richard Stevens (PHI),Unix Network Programming

Online Resources:

1. <https://nptel.ac.in/courses/106/104/106104019>
2. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFI-O29szjTrs_O



Course Plan

Course Title : Computer Algorithms Laboratory	
Course Code:231AIMLPCCP205	Semester: IV
Teaching Scheme: L-T-P:0-0-2	Credit:1
Evaluation Scheme: ISE + MSE Marks : NA	POE : 25

Course Description: This course introduces basic methods for designing and analyzing efficient algorithms. Different algorithms for a given computational task are presented and their relative merits are evaluated based on performance measures. It introduces the fundamental techniques for designing and analyzing algorithms, including asymptotic analysis, divide-and-conquer algorithms, greedy algorithms, dynamic programming, traversal methods, and even a backtracking approach. It also provides an introduction to NP-completeness.

Course Objectives:

1. To introduce algorithm design methods/techniques with analysis.
2. To devise algorithm for given problem statement and compute its complexity.
3. To introduce complex computational problems

Course Outcomes:

Upon successful completion of the course, student will be able to...

COs	Course Outcomes
PCCP205.1	Understand and demonstrate algorithm design methods with analysis
PCCP205.2	Devise algorithm for given problem statement and analyze its space and time complexity by using recurrence relation
PCCP205.3	Categorize the problem to determine polynomial and non-polynomial based on its Nature.

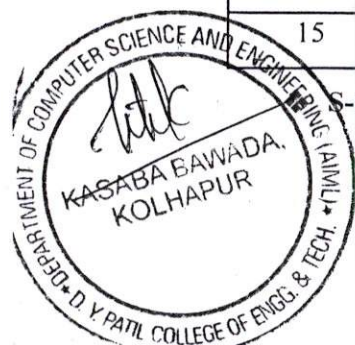
Prerequisite:	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts.
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Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
PCCP205.1	2	2	-	1	1	-	-	-	-	-	-	-	-	-	3
PCCP205.2	3	1	-	1	1	-	-	-	-	-	-	-	2	-	3
PCCP205.3	-	2	-	-	1	-	-	-	-	-	-	-	-	-	4

Exp. No.	Name of the Experiment	S/O	Hours
1	Implementation and analysis of Binary search algorithm.	O	2
2	Implementation and analysis of Finding the maximum and minimum among the given list of integers.	O	2
3	Implementation and analysis of Merge sort algorithm.	O	2
4	Implementation and analysis of Quick Sort algorithm.	O	2
5	Implementation and analysis of DC Selection Algorithm.	O	2
6	Implementation of Knapsack problem	O	2
7	Implementation of Job sequencing with deadlines.	O	2
8	Implementation of Prim's and Kruskal's algorithms.	O	2
9	Implementation of Optimal Merge Patterns.	O	2
10	Implementation of Single source shortest paths.	O	2
11	Implementation of All pair shortest paths.	O	2
12	Implementation of Traveling Salesperson problem	O	2
13	Implementation of Breadth First Search and Depth First Search	O	2
14	Implementation of a sum of subsets	O	2
15	Implementation of the Hamiltonian Cycle.	O	2

S-STUDY, O-OPERATIONAL



Text Books:

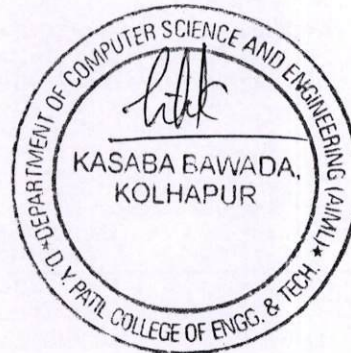
1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasekaran University Press, Second Edition (All Units)

Reference Books:

1. Data Structures and Algorithmic Thinking with PYTHON (Data Structure and Algorithmic Puzzles) Narasimha Karumanchi (MTech IIT Bombay) Career Monk Publications (Refer for String Algorithms in unit 5)
2. Fundamentals of Algorithms Gilles Brassard, Paul Bratley, Pearson Education.
3. Mastering Algorithms with C Kyle Loudon SPDO'Reilly.
4. Computer Algorithms-Introduction to Design and Analysis Sara Baase, Allen Van Gelder, Pearson Education.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms," Third Edition PHI 2010.

Online Resources:

1. <https://nptel.ac.in/courses/106/104/106104019>
2. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rr148XKpZkf03iYFI-O29szjTrs_O



Course Plan

Course Title: MDM-2-Data Handling with R Programming	
Course Code: 231AIMLMDML202	Semester: IV
Teaching Scheme: L-T-P: 2-0-0	Credit: 2
Evaluation Scheme: ISE Marks: 20	ESE Marks: 30

Course Description: -

R is a well-developed, simple, and effective programming language, that includes conditional loops, user defined recursive functions, input and output facilities, graphical facilities for data analysis, and an effective data handling and storage facility. It is a very flexible language. It provides an extensive, coherent, and integrated collection of tools for data analysis and it is actively used for statistical computing and design.

Course Objectives

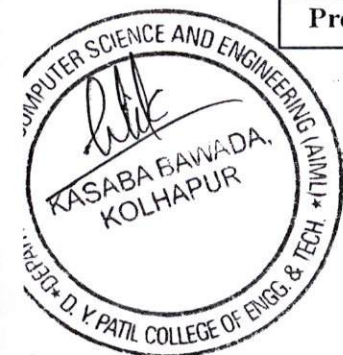
1. To make students aware of the features of R.
2. To provide knowledge of various packages & functions used in R.
3. To interpret and apply R programming from a statistical perspective.

Course Outcomes

After successful completion of the course, students will be able to-

CO's	Course Outcomes
MDML202.1	Use the features of R to implement data structures & data frames in their application.
MDML202.2	Apply different packages & functions to create the application.
MDML202.3	Perform data manipulation & statistical tests on dataset.
MDML202.4	Perform graphical analysis using plotting commands & functions.

Prerequisite	Python programming
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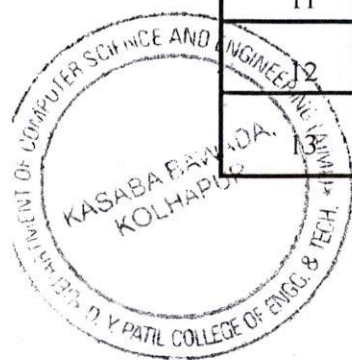
Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
MDML202.1	2	-	2	-	-	-	-	-	-	-	-	-	-	-	3
MDML202.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	3
MDML202.3	2	2	3	-	2	-	-	-	-	-	-	-	2	-	3
MDML202.4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	3

Contents	Hours
Unit 1: Introduction to R programming What is R? Basic Features of R, Programming features of R, Installing R and RStudio, RStudio Overview, working in the R Console, Getting Help in R and Quitting RStudio.	4
Unit 2: R Data structures and Manipulation Creating Variables, expressions, R data types and objects, Numeric, Character and Logical Data, Vectors, Scalars, Declarations, Common Vector operations, Conditional statements and loops, Arithmetic Operators, and Logical Operations. Reading datasets and exporting data from R, Manipulating and processing data in R.	6
Unit 3: R packages and functions Building R Packages, Installing and loading packages, Running and Manipulating Packages, Setting up your working directory, Downloading and importing data, working with objects, Viewing Objects within Objects, Constructing Data Objects, Functions in R, Creating functions, calling functions, Writing R scripts.	5
Unit 4: Matrices, Arrays and Lists Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, Vector/Matrix Distinction, Avoiding Dimension Reduction, Higher Dimensional arrays. Lists – Creating lists, General list operations, accessing list components and values, applying functions to lists, recursive lists.	5
Unit 5: Data Frames Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors, Working with tables, functions are objects, Environment and Scope issues, Writing	5

Upstairs, Recursion, Replacement functions, Tools for composing function code.	
Unit 6: Introduction to Graphical Analysis and plots Using Plots (Box Plots, Scatter plot, Pie Charts, Bar charts, Line Chart), Plotting variables, Designing Special Plots, Histograms. Statistical functions for central tendency, variation, handling of bivariate data through graphics, Simple Liner Regression, Multiple Regression, and Interactive reporting with R markdown.	5

List of Experiments			
Expt. No.	Name of Experiment	S/O	Hours
1	Installation of R and R Studio.	O	2
2	Demonstration of declaring R variables, objects, expressions, vectors and assigning values & Perform program for reading data from R and writing data into R.	O	2
3	Implementation of package in R & creates a program for calling functions in R.	O	2
4	Perform various matrix operations and implement the higher dimensional array in R.	O	2
5	Create list in R and perform various list operations to access list elements in R.	O	2
6	Create a data frame in R and perform various operations on data frame & Demonstrate the common functions on factors and tables in R	O	2
7	Demonstration of plots in R as Box Plots, Pie Charts, Bar charts, Line Chart and histogram.	O	2
8	Study of Simple Linear Regression and Multiple Regression in R.	S	2
9	Write an R script to find subset of dataset by using subset (), aggregate() functions on iris dataset.	O	2
10	Create and customize histograms using R programming	O	2
11	Show Advanced Plot Techniques with ggplot2	O	2
	Perform complex data frame operations.	O	2
	Perform advanced operations on lists or complex list manipulations	O	2



14	Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not.	O	2
15	Mini-Project	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

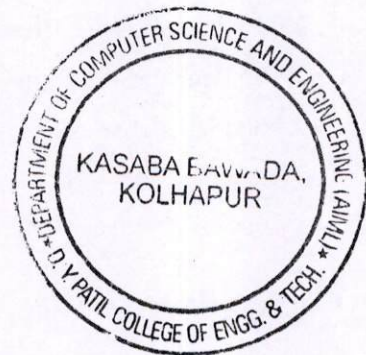
1. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series.
2. Norman Matloff, "The Art of R Programming."

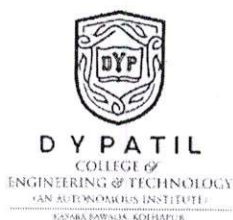
Reference Books:

1. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
2. Mark Gardener, "Beginning R – The Statistical Programming Language", Wiley, 2013.
3. Michael Akritas, "Probability & Statistics with R for Engineers and Scientists", 2nd Edition, CRC Press, 2016.

Online Resources:

1. <https://www.coursera.org/learn/r-programming>





D.Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY,
KASABA BAWADA, KOLHAPUR-416006
 (An Autonomous Institute) B. Tech. Curriculum
 S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- IV (Academic Year-2024-25)

Course Plan

Course Title : Environmental Studies	
Course Code : 201AIMLVECL202	Semester : IV
Teaching Scheme : L-T-P : 2-0-0	Credits : 2
Evaluation Scheme : NA	ESE Marks : 50

Course Description:

The main objective of course is to create awareness among students regarding environmental issues and its impact on society. Knowledge regarding environmental components, its degradation and protection of the environment is needed for a sustainable future ahead.

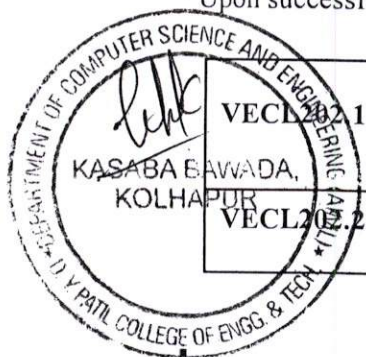
Course Objectives:

1. Understand the scope and importance of Environmental Studies and sustainable development
2. Understand connection between environmental health and developmental activities
3. Understand the importance of Environmental Management for its protection from technical and legislative point of view
4. Acquire problem solving skills through visits to different locations, identifying environmental problems and proposing solution for societal benefits

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

VECL202.1	Understand the scope and importance of Environmental awareness and Sustainable development
VECL202.2	Understand various Environmental issues due to development



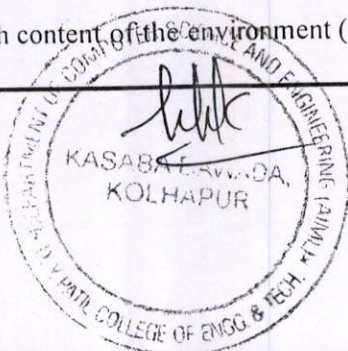
VECL202.3	Understand various modes of Environmental management through technology and legislation
VECL202.4	Acquire problem solving attitude through actual field experience, reporting it in the form of Field project work.

Prerequisite:	Understanding of Environmental Education course
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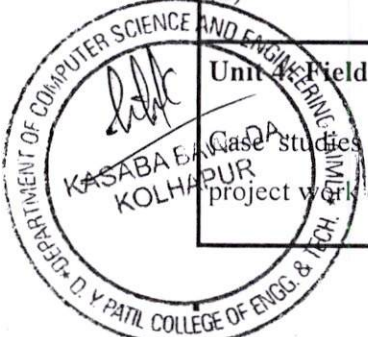
Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BT L
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
VECL202.1	-	-	-	-	-	1	3	2	-	-	-	2	-	-	2
VECL202.2	-	-	-	-	-	1	3	1	-	-	-	2	-	-	2
VECL202.3	-	-	-	-	-	1	3	1	-	-	-	2	-	-	3
VECL202.4	-	-	-	-	-	2	3	1	-	1	1	2	-	-	3

Content	Hours
<p>Unit 1: Our Environment</p> <p>Introduction to Environment, Scope of Environmental studies, importance of environmental awareness (1) Concept of sustainability, Sustainable Development- history and Goals, environmental ethics, Sustainability ethics (3) Population growth of world and reduced health content of the environment (1)</p>	05



<p>Unit 2: Development and Environmental health:</p> <p>Natural resources (8) Types (renewable and non-renewable), developmental benefits, Forest- Benefits, problems (Deforestation), Biodiversity-- importance, threats, conservation, Ecosystems- importance, problem associated with major ecosystems, ecological restoration, Air- Benefits, problems (Pollution, climate change), Water- Benefits, problems (Depletion, pollution), Soil/ Land- Benefits, problems (Degradation, loss of fertility, desertification), Mineral- Benefits, problems (Mining, over exploitation, depletion, pollution), Energy resources- Benefits, problems (depletion, energy crisis)</p> <p>Urbanization and Environmental health (2) Urban problems, Solid waste- Effects of MSW, Plastic waste, Hazardous waste, E- waste</p>	10
<p>Unit 3: Environmental Management</p> <p>Renewable energy technologies- current, new (Bio gas, Bio fuel, hydrogen, etc) (1), Pollution abatement – SR, ZLD, carbon credit, bio remedies (1), Soil/ land reclamation, Sustainable agriculture (1), Concept of EIA, Environmental audit, ISO certification (ISO 14001) (2), Role of CPCB and MPCB in Environmental protection of India (1)</p> <p>Emerging technologies for environmental management- GIS, Remote sensing, Smart bin, IoT integration, Waste-to-Energy Technologies, Recycling Automation, Advanced Data Analytics, Circular Economy Practices, Sustainable Packaging Solutions, Community Engagement and Education, Decentralized Waste Treatment, Zero-Waste Initiatives, Legislative and Regulatory Changes (2)</p> <p>Environmental legislation- Environmental Protection Act, Air Act, Water Act, Solid waste Management Act, Hazardous waste Management Rule, E- Waste (Management) Rules, 2022 (2)</p>	10
<p>Unit 4: Field project work</p> <p>Case studies based on site visit (Each candidate has to go for field visit and complete a project work on Environmental issues and probable solutions)</p>	05



Text Books:

1. Handbook of Environmental Studies by Dr. G. R. Parihar, Publisher: Satyam Publishers and Distributors (1 January 2013)
ISBN-10 : 9382664408
ISBN-13 : 978-9382664406
2. Environmental Studies by Anubha Kaushik, New Age International Private Limited (1 January 2007)
ISBN-10 : 8122422403
ISBN-13 : 978-8122422405
3. Introduction to Environmental Engineering and Science 3e, by Masters, Publisher : Pearson Education India; 3rd edition (1 January 2015)
ISBN-10 : 9332549761
ISBN-13 : 978-9332549760
4. Solid Waste Management in developing countries, by Bhide A. D. and Sundersen B. B.- Indian National Scientific Documentation Centre, New Delhi

Reference Books:

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I &II, Environmental Media
2. Ecology And Environment Pb, by P. D. Sharma, Rastogi Publications (1 January 2011)

Online Resources:

1. Environmental English Book 1-3-2022 Final Corrected copy_compressed.pdf
2. Manual on Municipal Solid Waste Management- Ministry of Urban Development, Govt. of India

Course Plan

Course Title: Software Engineering and Project Management	
Course Code: 231AIMLHSSML202	Semester: IV
Teaching Scheme: L-T-P: 1-0-2	Credits: 2
Evaluation Scheme: ISE + MSE Marks: 25 + 30	ESE Marks: NA

Course Description:

This course acts as guidelines for software development. It commences the main methodologies of software engineering and the Software Development Life Cycle (SDLC). It also contains exposure to different tools and models that play an important role in SDLC.

Course Objectives:

1. To give importance of SDLC in their project to expose the students to basic concepts and principles of software engineering.
2. To make the students aware of the development.
3. To expose the students to agile processes.

Course Outcomes (COs):

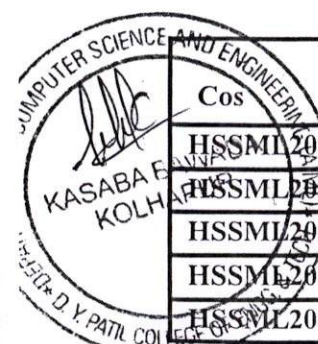
Upon successful completion of this course, the students will be able to:

HSSML202.1	Understand systematic methodologies of SDLC.
HSSML202.2	State SRS for their problem domain.
HSSML202.3	Use UML for Object Oriented Modelling.
HSSML202.4	Understand coding, testing methods and the importance of software maintenance.
HSSML202.5	Understand in detail agile processes.

Prerequisite:	Students must know C programming language and OOP's concepts.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
HSSML202.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
HSSML202.2	2	2	-	-	-	-	-	-	-	2	-	2	-	-	1
HSSML202.3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3
HSSML202.4	2	-	2	-	2	-	-	-	-	-	-	-	-	-	2
HSSML202.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2



Content	Hours
Unit 1: Introduction to Software and Processes Software, Software Engineering as layered approach and its characteristics, Software process framework, process models: Perspective Process Models, Specialized process models. Agile software development: Agile process and its importance, Scrum, DSDM, Crystal.	3
Unit2: Software Requirements Analysis/Engineering Software engineering practices & its importance, core principles, Requirement Engineering: requirement gathering and analysis, types of requirements, Developing use cases, Software requirement specification: need of SRS, format and its characteristics.	2
Unit 3: Software Modeling, Design, Project Estimation Translating requirement model into design model, Design modeling, Design notations, The management spectrum- 4P's, Metrics for size estimation: Function Point(LoC), Function Points(FP), COCOMO, COCOMO II, Risk Management: Risk (Identification, Assessment, Containment), RMMM strategy.	2
Unit 4: Software Quality Assurance & Security Project Scheduling: Basic principles, Work breakdown structure, Project Tracking: Timeline charts, Phases of software quality assurance, quality Evaluation standards: Six Sigma, ISO for software, CMMI: levels, process areas. Software Security, Introduction to DevOps, secure software engineering	3
Unit 5: Basics of Software Testing, Types & levels of Testing Software testing, Testing terminologies, Test case, Entry and Exit criteria, verification & validation, QC, QA, Methods of testing, White Box testing & black box testing, levels of testing	2
Unit 6: Manual and Automation Testing Testing on web app., Performance Testing, Acceptance Testing, Test planning, Test Management, Test Process, Test Reporting, Manual Testing & Automated Testing tools	

List of Experiments			
Exp. No.	Name of Experiment	S/O	Hours
1	Gather application-specific requirements for integration into the RE (Requirements engineering) model.	S	2
2	Prepare broad SRS (software requirement specification) for the above-selected project.	S	2
3	Prepare use-cases and draw use-case diagrams using a software modeling tool	O	2
4	Identify risks involved in the project and prepare an RMMM (RMMM-Risk Management, Mitigation and Monitoring) plan.		
5	Draw a class diagram, sequence diagram, collaboration diagram, and state transition diagram for the assigned project.	O	2
6	Design test cases for Web Pages Testing any Web Sites	O	2
7	Write a program and design test cases for the following control and decision-making statements. 1) For...Loop 2) Switch...Case 3) Do... While 4) If...else	O	2
8	Prepare a test plan for an identified Mobile application.	O	2
9	Prepare defect reports after executing test cases for a library management system.	O	2
10	Design test plan and Test cases for any application to prepare Requirements Traceability Matrix (RTM)	O	2
11	Design test plan and Test cases for Notepad/ Word Pad (MS window based). Using Automated tool	O	2
12	Design test plan and Test cases for OpenCart sample online store using a cypress automation tool	O	2
13	Design Test cases for any Mobile application and test by using the Appium automation tool.	O	2
14	Design Test cases for any application to do load testing and stress test by using JMeter automation tool.	O	2
15	Design Test cases for any application to do database testing by using the ETL automation tool.	O	2

STUDY, O-OPERATIONAL



Text Books:

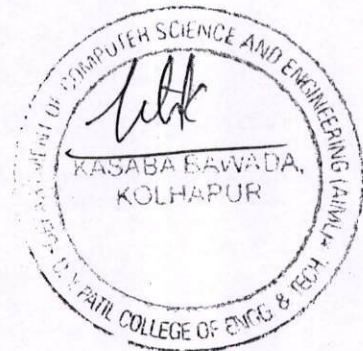
1. Software Engineering: A practitioner's approach, Pressman, Roger S, McGraw Hill Higher Education, New Delhi, ISBN 978-0-07-337597-7
2. Software Engineering Concepts, fairly, Ricard, McGraw Hill Higher Education, New Delhi-2001, ISBN-13: 9780074631218
3. Software Testing: principles and practices, Srinivasan Desikan, Gopalswamy Remesh, PEARSON publisher: person India2005, ISBN:9788177581218
4. Software testing: Principles, techniques and tools, Limaye M.G., tata McGraw Hill Education, New Delhi., 2007 ISBN 13:9780070139909
5. Software Testing, singh Yogesh, Cambridge University Press, Bangluru, ISBN 978-1-107-65278-1

Reference Books:

1. Hansvan Vliet, "Software Engineering Principles and Practice", Willey-India Edition.
2. Sommer Ville, "Software Engineering", Pearson Education, India.
3. P Fleeger, "Software Engineering", Pearson Education, India.
4. Software Testing, singh Yogesh, Cambridge University Press, Bangluru, ISBN 978-1-107-65278-1
5. Software Engineering: principles and practices, Jain, Deepak, Oxford University press, New Delhi ISBN 97801956694840

Online Resources:

1. <http://www.selenium.com>
2. http://en.wikipedia.org/wiki/Test_automation
3. www.toolsqa.com
4. www.versionone.com/agile-101/
5. www.sei.cmu.edu
6. https://onlinecourses.nptel.ac.in/noc21_cs13/course



Course Plan

Course Title: AR-VR with Mini Project	
Course Code: 231AIMLAECP201	Semester: IV
Teaching Scheme: L-T-P: 1-0-2	Credits: 2
Evaluation Scheme : ISE + MSE Marks: NA	INT : 25 , POE : 25

Course Description:

This course provides an in-depth introduction to Augmented Reality (AR) and Virtual Reality (VR) technologies, exploring their fundamental principles, applications, and potential impact across various industries. Students will gain hands-on experience with creating AR/VR content and applications, using industry-standard software and development tools.

Course Objectives:

1. To gain knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
4. To learn the evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to gain practical knowledge

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

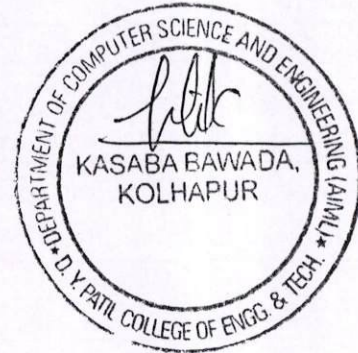
COs	
AECP201.1	Understand fundamental Computer Vision, Computer Graphics and Human Computer Interaction Techniques related to VR/AR
AECP201.2	Understand the Virtual Environment
AECP201.3	Analyze and Evaluate VR/AR Technologies
AECP201.4	Apply various types of Hardware and Software in Virtual Reality systems
AECP201.5	Design and Formulate Virtual/Augmented Reality Applications



Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
AECP201.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
AECP201.2	2	2	-	-	-	-	-	-	-	2	-	2	-	-	1	
AECP201.3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3	
AECP201.4	2	-	2	-	2	-	-	-	-	-	-	-	-	-	2	
AECP201.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	

Prerequisite:	Mathematics, Physics, Programming and Problem Solving, Artificial Intelligence
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Content	Hours
Unit 1 : Introduction Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality	3
Unit 2 : VR Systems VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays	2
Unit 3 : VR Software Development Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available SDKs to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR)	3
Unit 4 : AR Software Development AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.	3
Unit 5 : Application of VR in Digital Entertainment: VR technology in film & TV production. VR technology in physical exercises and games. Demonstration of Digital Entertainment by VR.	3
Unit 6 : AR VR Project Finalizing topics in AR and VR for project	1

Exp. No.	Name of the Experiment	S/O	Hours
1	Installation of Unity and Visual Studio, setting up Unity for VR development, and understanding documentation of the same.	S	2
2	Demonstration of the workings of HTC Vive, Google Cardboard, Google Daydream, and Samsung Gear VR.	S	2
3	Develop a scene in Unity that includes: i) A cube, plane, and sphere, apply transformations to the 3 game objects. ii) Add a video and audio source.	S	2



4	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click.	O	2
5	Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects. Write a C# program to grab and throw the sphere using vr controller	O	2
6	Develop a simple UI (user interface) menu with images, canvas, sprites and buttons. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene	O	2
7	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or using available 3D models.	S	2
8	Include animation and interaction in the immersive environment created in Assignment 7.	S	2
9	Develop a VR Ball Game. The scene should contain a play area surrounded by four walls and a ball that acts as a player. The objective of the game is to keep the ball rolling without colliding with the walls. If it collides with either of the walls, the wall color should change and a text should display on the screen indicating the collision.	O	2
10	Develop a VR Golf Game. The scene should contain a play area (golf course), which consists of a series of cups/holes each having different scores. Display the score card.	O	2
11	Develop a VR game in Unity such that on each gun trigger click, destroy the cubes placed on the plane and gain a score point. Make a score UI and display it on the screen .	S	2
12	Develop a VR Basketball Game. The scene should contain a	O	2

	basketball court. The developed game should be a single player game. The objective of the game is to let the player put the ball in the basket the maximum number of times. Display the score card.		
13	Develop an AR bowling game with one image target .The image target should include 3d models as per requirement. Write a c# program to develop score point system for bowling game. Build an apk. (Note : Vuforia plugin should be installed in unity.)	O	2
14	Develop a VR environment for flying helicopter/moving car simulation.	O	2
15	Mini-Projects/ Case Study A) Create a virtual environment for any use case. The application must include at least 4 scenes that can be changed dynamically, a good UI, animation, and interaction with game objects. (e.g VR application to visit a zoo) B) Create a multiplayer VR game (battlefield game). The game should keep track of score, no. of chances/lives, levels (created using different scenes), involve interaction, animation, and immersive environment.	O	2

❖ S-STUDY, O- OPERATIONAL

Text Books:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
 2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
 3. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
 4. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
- Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

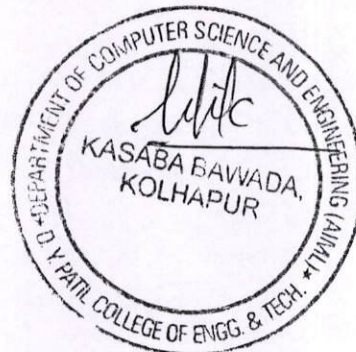


Reference Books:

1. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381 2.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Online Resources:

1. <http://lavalle.pl/vr/book.html>
2. <https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf>
3. <https://docs.microsoft.com/en-us/windows/mixed-reality/>
4. <https://docs.microsoft.com/en-us/archive/msdn/magazine/2016/november/hololensintroduction-to-the-hololens>



Course Plan

Course Title: OEC-II – Foundations of Artificial Intelligence	
Course Code: 231AIMLOECL202	Semester: IV
Teaching Scheme: L-T-P: 2-0-0	Credits: 2
Evaluation Scheme : NA	ESE Marks: 50

Course Description:

AI is a part of computer science based on the theoretical and applied principles of that field. These principles include the data structures used in knowledge representation, the algorithms needed to apply that knowledge, and the languages and programming techniques used in their implementation.

Course Objectives:

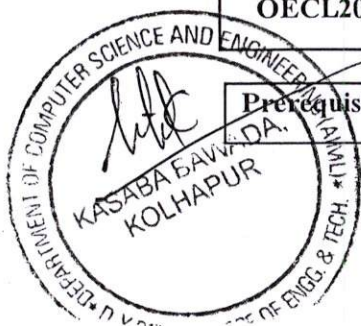
1. To familiarize students with Artificial Intelligence principles and techniques.
2. To introduce the facts of computational models and their applications.
3. To explore problem-solving paradigms, search methodologies and learning algorithms.
4. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

COs	
OECL202.1	Characterize different types of AI environments, transform a given real world problem to state space problem, understand, and identify the stages and issues in the development of an expert system.
OECL202.2	Apply different searching algorithms and heuristic methodologies to reach the goal in state-space problems.
OECL202.3	Formulate a given real world problem formally using different ML knowledge
OECL202.4	Implement appropriate searching strategies for a real-world environment

Prerequisite	Mathematics & Basic Programming.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
OECL202.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	L-2
OECL202.2	2	3	3	-	-	-	-	-	-	-	-	-	2	-	L-3
OECL202.3	2	1	2	-	-	-	-	-	-	-	-	-	2	-	L-3
OECL202.4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	L-3



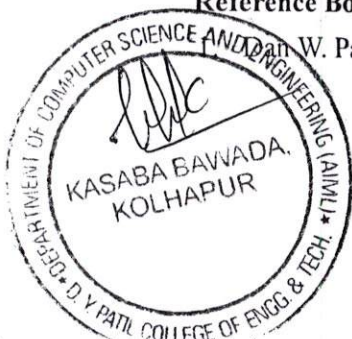
Content	Hours
Unit 1: Introduction Importance of AI, Evolution of AI, Application of AI, Classification of AI concerning environment, Intelligent agents, Different types of agents	5
Unit 2: Search Representation Problem-solving by Search, Problem space - State space, Blind Search - Types, Performance measurement. Types, Game playing mini-max algorithm, Alpha-Beta Pruning, Depth-first search, Breadth first search.	5
Unit 3: Uncertainty Handling Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, MDP formulation, utility theory, utility functions, Propositional Logic and Predicate Logic in AI, sliding window algorithm in AI	5
Unit 4: Machine Learning Systems Forms of Learning Types - Supervised, Unsupervised, Reinforcement Learning, Learning Decision Trees. Expert Systems - Stages in the development of an Expert System - Probability-based Expert Systems - Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems	5
Unit 5: Reinforcement Learning Passive reinforcement learning, Direct utility estimation, Adaptive dynamic programming, Temporal difference learning, Active reinforcement learning- Q learning.	5
Unit 6: Python for ML Study of important inbuilt libraries of Python like NumPy, SciPy, Matplotlib, Installing Python. Setting up PATH. Running Python. Study of basic applications of AI with Python	5

Text Books:

1. Gorge F Luger, "Artificial Intelligence; structures and strategies for complex problem solving", Pearson Education, 5th Edition. [Units 1, 2, 3 &6]
2. Michael Negnevitsky, "Artificial Intelligence: A guide to intelligent systems", Person Education, 2nd edition. [Units 4, 5]
3. Giancarlo Zaccane, "Getting started with Tensor Flow", Packt Publishing, 2016. [Unit6].

Reference Books:

1. W. Patterson, Introduction to Artificial Intelligence, Pearson Education India, 6 January 2015



Online Resources:

1. <https://nptel.ac.in/courses/106/102/106102220/>
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview





D.Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY,
KASABA BAWADA, KOLHAPUR-416006
 (An Autonomous Institute) B. Tech. Curriculum
 S.Y. B.Tech. CSE (Artificial Intelligence and Machine Learning)
SEM- IV (Academic Year-2024-25)

Course Plan

Course Title : Web Technologies	
Course Code : 231AIMLVSECP201	Semester : IV
Teaching Scheme : L-T-P : 1-0-2	Credits : 2
Evaluation Scheme : ISE + MSE Marks : NA	INT + POE Marks : 25 + 25

Course Description:

This course provides the knowledge about creation of static, dynamic and interactive web application with the help of HTML, CSS, JavaScript and PHP. These technologies can be used for developing client-side, server-side web pages for their specific web applications. The course also includes designing your own structure with the help of XML and related technologies applied in various domains.

Course Objectives:

1. To introduce students to front end web design and emerging web technology concepts and tools.
2. To build the foundations of client side scripting languages and validation techniques.
3. To expose the students to different XML concepts and their applications.
4. To develop real life web applications using HTML and PHP.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

VSECP201.1	Understand front end web design techniques and develop the web applications.
VSECP201.2	Apply the knowledge of JavaScript to designing and validating the application.
VSECP201.3	Use the different XML concepts for building the XML structure.
VSECP201.4	Create a web application to solve real life problems using HTML and PHP.



Prerequisite:	Object oriented Programming
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
VSECP201.1	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-3
VSECP201.2	2	-	1	-	2	-	-	-	-	-	-	-	-	-	L-3
VSECP201.3	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-3
VSECP201.4	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-6

Content	Hours
Unit 1: Introduction - Internet & Websites, HTML: Internet-Basics, Internet Protocols (HTTP, FTP, IP), World Wide Web(WWW), Web Browser, Web Server, Types, Types of Websites (Static and Dynamic Websites), Web Development lifecycle, Basics of web hosting. Introduction to HTML, History, Features ,HTML tags & attributes , HTML Form elements , HTML Frameset , Limitations of HTML.	2
Unit 2: CSS Basics of CSS, Syntax , Types of CSS, Importance of CSS , CSS Selectors-Group, id, class , CSS properties- Border, background, list, image, margins , Advantages and limitations of CSS	2
Unit 3: Java Script Introduction to JavaScript, Difference between client side and server side scripting.	2



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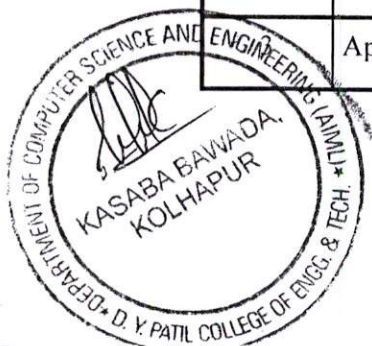
(An Autonomous Institute) B. Tech. Curriculum

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SEM- IV (Academic Year-2024-25)

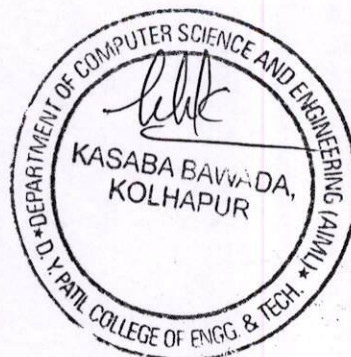
Identifier & operators , Control structure , Dialog boxes , Functions , Event Handling , Objects, Form Validation	
Unit 4: HTML 5 Introduction to HTML5, Difference between HTML and HTML5, HTML5- Attributes, events , HTML5 canvas, HTML5 Audio & Video , HTML5 Drag & Drop ,Web Forms 2.0	3
Unit 5: XML Basics The benefits of XML, What XML, Portable Data, How XML Works, XML Documents and XML Files, Elements, Tags and Character Data, Attributes, XML Names, References, CDATA Sections, Comments, Processing Instructions, The XML Declaration, Checking Documents for well-formedness.	3
Unit 6: PHP- Hypertext Pre-processor PHP Basics, Data Types, Identifiers, Variables, Constants, Expressions, and Control Structures, Functions, Arrays, array functions, Classes and Objects, State Management: what Is Session Handling, Working with Sessions, Examples, PHP cookies, Uploading Files with _FILES, Interacting with the Database with MySQLi, Executing Database Transactions	3

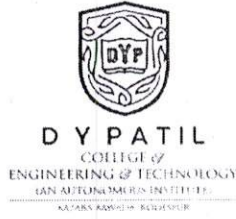
List of Experiments			
Exp. No.	Name of Experiments	S/O	Hours
1	Create html pages for website like login, registration and about us pages	O	2
2	Design and develop a static website using HTML tags.	O	2
	Apply and design the created HTML pages using CSS	O	2



4	Write a JavaScript that displays text with an increasing font size in the interval of 100 ms in red colour.	O	2
5	Write a JavaScript to design a simple calculator.	O	2
6	Write a program demonstrating javascript functions and different validations on the registration page.	O	2
7	Study and implementation of XML.	S	2
8	Study of PHP basics along with different modern tool installation and configuration.	S	2
9	Implementation of PHP array with different functions.	O	2
10	Implementation object-oriented concepts in PHP.	O	2
11	Implementation of form and extract the user input using \$_GET or \$_POST	O	2
12	Use an XML parser to check the well-formedness of XML documents.	O	2
13	Perform database operations using PHP and MySQL	O	2
14	Implement session handling to maintain state across web pages.	O	2
15	Design and develop a mini project for solving the different real time problems using web Technologies in the group of 2 students	O	2

❖ S-STUDY, O-OPERATIONAL





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SEM- IV (Academic Year-2024-25)

Text Books:

1. Michael Bowers, Dionysios Synodinos and Victor Sumner, "Pro HTML5 and CSS3 Design Patterns", Apress edition (Unit I & II)
2. Atul Kahate, "XML and Related Technologies", Pearson .
3. Douglas Crockford , "JavaScript: The Good Parts", O'Reilly .
4. W. Jason Gilmore, "Beginning PHP and MySQL: From Novice to Professional", 4th Edition.
5. Web Development and Design Foundations with HTML5- Terry A. Felke-Morris.

Reference Books:


1. Michael Bowers, Dionysios Synodinos and Victor Sumner, "Pro HTML5 and CSS3 Design Patterns", Apress edition.
2. Elliotte Rusty Harold, W. Scott Means, "XML in a Nutshell", O'Reilly Publication, 3rd Edition.


Online Resources:

1. https://onlinecourses.swayam2.ac.in/ugc19_lb05/preview


HOD

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Computer Science and Engineering
(Artificial Intelligence and Machine Learning)
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Principal



Course Plan

Course Title: Liberal Learning Course- I Augmented Reality (AR) and Virtual Reality (VR) Club	
Course Code: 231AIMLCCAP201	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: <i>Audit</i>
Evaluation Scheme: ISE Marks: 50	ESE Marks: NA

Course Description:

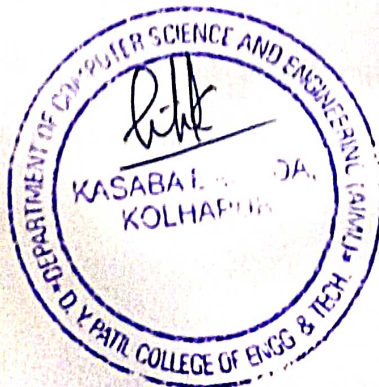
This course provides an in-depth introduction to Augmented Reality (AR) and Virtual Reality (VR) technologies, exploring their fundamental principles, applications, and potential impact across various industries. Students will gain hands-on experience with creating AR/VR content and applications, using industry-standard software and development tools.

Aims:

1. To gain knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
4. To learn the evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to gain practical knowledge.

Course Objectives:

1. **Gain Knowledge of Virtual Reality:** Acquire a comprehensive understanding of the historical development and modern perspectives of virtual reality.
2. **Learn Fundamentals of Sensation and Perception:** Understand the basic principles of sensation, perception, and the techniques used in perceptual training.
3. **Understand Technical Aspects of AR and VR:** Study the scientific, technical, and engineering principles that underpin augmented and virtual reality systems.
4. **Evaluate VR Design:** Develop the ability to assess virtual reality systems from a design perspective.
5. **Implement Augmented Reality Technology:** Gain practical experience by learning and applying the technology of augmented reality.



Course Outcomes (COs):

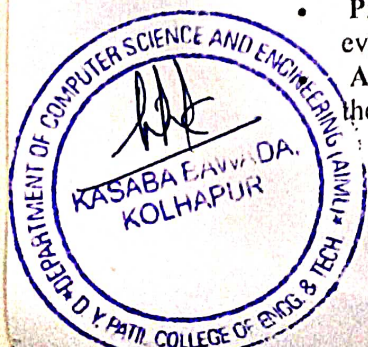
At the end of the course, the student should be able to:

CCAP201.1	Students will be able to demonstrate a comprehensive understanding of the historical development and contemporary perspectives on virtual reality.
CCAP201.2	Students will be able to explain the basic principles of sensation and perception and apply techniques used in perceptual training.
CCAP201.3	Students will be able to analyze and apply the scientific, technical, and engineering principles of augmented and virtual reality systems.
CCAP201.4	Students will be able to evaluate and critique virtual reality systems from a design perspective.
CCAP201.5	Students will be able to implement augmented reality technology in practical scenarios, demonstrating hands-on experience and knowledge.

Prerequisite:	Basic Knowledge of Programming
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Evaluation Guidelines

- **Attendance:** Regular attendance in bootcamps, workshops, and club meetings focused on AR-VR technologies.
 - **Engagement:** Active participation in discussions, Q&A sessions, and group activities related to AR-VR.
 - **Teamwork:** Collaboration with peers on AR-VR projects and challenges.
 - **Technical Proficiency:** Ability to operate AR-VR hardware, use relevant software (e.g., Unity, Unreal Engine, AR development kits), and troubleshoot common issues.
 - **Project Execution:** Successful completion of assigned AR-VR projects and tasks within the given timeframe.
 - **Innovation:** Demonstration of creativity and innovative thinking in AR-VR project design and implementation.
 - **Event Participation:** Involvement in organizing and participating in AR-VR competitions, workshops, and awareness campaigns.
 - **Community Building:** Contribution to building a supportive and collaborative AR-VR club environment.
 - **Competition Performance:** Participation and performance in internal and external AR-VR competitions.
 - **Project Showcase:** Presentation of completed AR-VR projects during club meetings or events.
- Awards and Accolades:** Recognition received for outstanding work and contributions in the field of AR-VR.





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(Academic Year-2024-25)

Certification Levels

Beginner Level Certification:

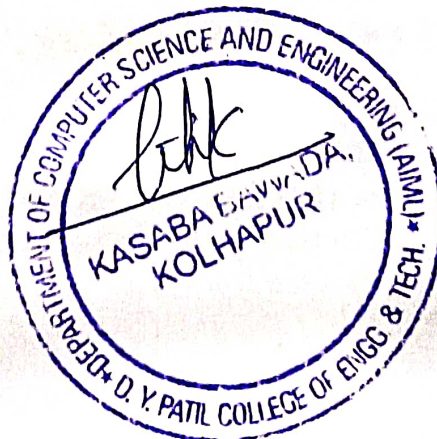
- **Attendance:** Attend at least 75% of the AR-VR bootcamps and workshops.
- **Project Completion:** Complete a basic AR-VR project (e.g., creating a simple AR experience or VR environment).
- **Concept Understanding:** Demonstrate understanding of basic AR-VR concepts and basic operation of AR-VR hardware and software.

Intermediate Level Certification:

- **Project Completion:** Successfully complete multiple AR-VR projects, including a complex design (e.g., an interactive VR simulation or a detailed AR application).
- **Competition Participation:** Participate in at least one internal AR-VR competition or challenge.
- **Technical Proficiency:** Show proficiency in troubleshooting and maintaining AR-VR hardware and software.

Advanced Level Certification:

- **Leadership:** Lead a team in a major AR-VR project or competition.
- **Event Organization:** Organize or contribute significantly to an AR-VR club event or workshop.
- **Knowledge Sharing:** Conduct a presentation or seminar on a specialized AR-VR topic.
Publish a Research Article in Journal or Conference



Course Plan

Course Title: Liberal Learning Course- II Microsoft Developer Club	
Course Code: 231AIMLCCAP:02	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: Audit
Evaluation Scheme: ISE Marks: 50	ESE Marks: NA

Course Description:

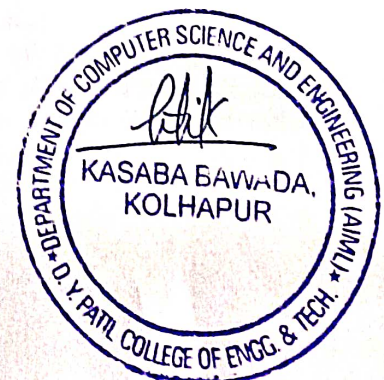
Microsoft Developer Club (MDC) is a distinguished global program specifically designed to empower students in their pursuit of knowledge, network expansion, and the application of technology for the betterment of their communities.

Aims:

1. Fostering a Community of Tech Enthusiasts
2. Enhancing Technical Proficiency.
3. Hosting Webinars and Microsoft Learn Challenges.
4. Technical Workshops and Training Sessions.
5. Participation in Microsoft Events and Competitions

Course Objectives:

1. **Skill Growth:** Enhance technical and soft skills in areas like coding, leadership, and community building.
2. **Global Community:** Connect with students from over 100 countries, fostering online communities and expanding influence.
3. **Certifications:** Receive training and earn certifications to validate expertise in various technologies.
4. **Impact:** Become agents of change, making a lasting impact on important projects and communities.
5. **Career Boost:** Boost resumes, personal growth, and online influence to kickstart careers.
6. **Access to Technologies:** Gain access to cutting-edge Microsoft technologies like Microsoft 365, Visual Studio Enterprise, and Azure.



Course Outcomes (COs):

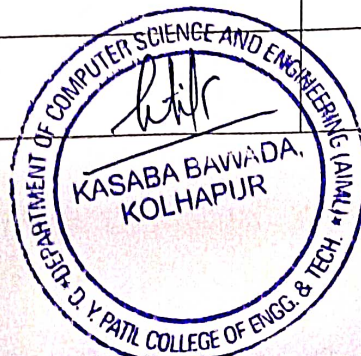
At the end of the course, the student should be able to:

CCAP202.1	Graduates will demonstrate heightened technical skills acquired through hands-on participation in coding challenges, webinars, and Microsoft Learn Challenges, providing them with a competitive edge in the job market.
CCAP202.2	Students will exhibit proficiency in organizing and hosting technical events, such as webinars, Microsoft Learn Challenges, showcasing their ability to plan and execute successful projects.
CCAP202.3	Graduates will contribute positively to the local community by leveraging their technical skills and knowledge gained through MLSA chapter involvement, fostering a culture of collaboration and making a tangible difference in the community.
CCAP202.4	Students will establish valuable connections within the tech industry, leading to mentorship opportunities, internships, and collaborative projects, thereby enhancing their career prospects and industry exposure.

Prerequisite:	Basic Knowledge of Programming
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SEM-3

Content Unit	Hours
Unit 1: Getting Started with LinkedIn Introduction to LinkedIn Creating Your LinkedIn Account Setting Up Your Profile Connecting with Others Following Companies and Influencers Understanding LinkedIn's Benefits	6
Unit 2 : Optimizing Your LinkedIn Profile Adding Your Work Experience Highlighting Your Education Showcasing Your Skills Including Projects and Achievements Managing Recommendations and Endorsements	6
Unit 3 :Using LinkedIn for Career Development Effective Job Searching on LinkedIn Expanding Your Professional Network	6





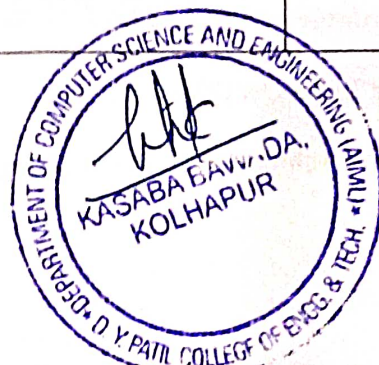
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(Academic Year-2024-25)

Engaging in LinkedIn Groups Accessing Learning Resources on LinkedIn Exploring Premium Features	
Unit 4: Understanding Git Introduction to Version Control Systems What is Git? Key Concepts in Git (Commits, Branches, Repositories) Installing Git Setting Up Your Git Configuration Basic Git Commands (Init, Clone, Add, Commit, Push)	6
Unit 5 : Getting Started with GitHub Introduction to GitHub Creating a GitHub Account Setting Up Git with GitHub Creating Your First Repository Using GitHub Desktop Collaborating on GitHub (Fork, Clone, Pull Request)	6
Unit 6: Advanced GitHub Usage Branching and Merging in Git Managing Collaborative Projects Reviewing Changes with Pull Requests Using Issues and Labels GitHub Pages for Hosting Projects	6

SEM-4

Content Unit	Hours
Unit 1: Introduction to Power BI Overview of Business Intelligence (BI) Introduction to Power BI Key Features and Capabilities of Power BI Installing Power BI Desktop Signing Up for Power BI Service Navigating the Power BI Interface	6
Unit 2: Getting Started with Power BI Connecting to Data Sources Loading and Transforming Data Creating Visualizations Building Interactive Dashboards Publishing Reports to Power BI Service Sharing and Collaborating on Power BI Reports	6
Chapter 3: Advanced Power BI Techniques Advanced Data Transformations Modeling Data with Relationships Using DAX (Data Analysis Expressions) Creating Custom Visuals	6



Setting up Row-Level Security Automating Reports with Power BI Service	
Unit 4: Introduction to Copilot Overview of AI-Powered Coding What is GitHub Copilot? Key Features and Capabilities of Copilot	6
Unit 5: Getting Started with Copilot Using Copilot for Code Suggestions Generating Code Snippets with Copilot Handling Different Programming Languages	6
Unit 6: Advanced Usage of Copilot Enhancing Productivity with Copilot Integrating Copilot in Development Workflows Privacy and Security Considerations	6

Evaluation Guidelines

1. Attendance (10 marks)
2. Collaboration and Teamwork (10 marks)
3. Practical Assignments (10 marks)
4. MSE (Member Self-Evaluation) (10 marks)
5. ESE (External Stakeholder Evaluation) (10 marks)

Certification Levels

Beginner Level Certification:

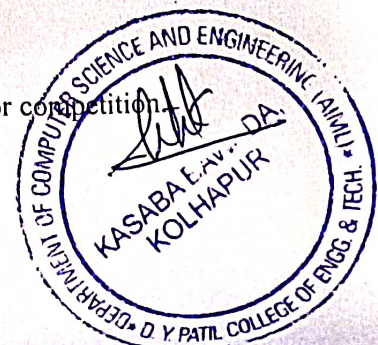
- **Attendance:** Attend at least 75% of the Microsoft Developer bootcamps and workshops.
- **Project Completion:** Complete a basic Microsoft project.
- **Concept Understanding:** Demonstrate understanding of basic concepts and basic operation related to Microsoft hardware and software.

Intermediate Level Certification:

- **Project Completion:** Successfully complete multiple Github, PowerBI projects, including a complex design.
- **Competition Participation:** Participate in at least one internal Microsoft Developer club competition.
- **Technical Proficiency:** Show proficiency in troubleshooting and maintaining Microsoft hardware and software.

Advanced Level Certification:

- **Leadership:** Lead a team in a major Microsoft Developer club project or competition.





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- **Event Organization:** Organize or contribute significantly to an Microsoft Developer club event or workshop.
 - **Knowledge Sharing:** Conduct a presentation or seminar on a specialized Microsoft Developer topic. Publish a Research Article in Journal or Conference

